FINAL Animal Agriculture Generic Environmental Impact Statement

Minnesota Planning Agency
Environmental Quality Board

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EXECUTIVE SUMMARY

The Generic Environmental Impact Statement on Animal Agriculture consists of the Final GEIS Summary Document, a Literature Research Summary, and a number of Technical Work Papers. The GEIS is a statewide study funded by the 1998 Minnesota Legislature. The Environmental Quality Board was directed to "…examine the long-term effects of the livestock industry as it exists and as it is changing on the economy, environment, and way of life of Minnesota and its citizens." The GEIS process provided a full public examination of the critical environmental, economic and social factors of animal agriculture through an open stakeholder-guided process. It also resulted in policy recommendations and a wealth of objective information for decision-makers.

The need for this study grew out of the controversy surrounding feedlots in Minnesota in the 1990s. As the number of new and expanding large-scale confinement animal production facilities increased, the same issues were raised repeatedly. Concerns were expressed about potential contamination of the air, and surface and ground water, and the economic and social impacts.

The GEIS investigations and documentation focused on the following topics:

A. Social/Community
B. Land Use
C. Role of Government
D. Industry Structure and Competitiveness
E. Profitability and Economic Viability
F. External Benefits and Costs
G. Water
H. Air Quality and Odor
I. Soils
J. Manure and Crop Nutrients
K. Human Health
L. Animal Health and Well-Being

All GEIS study phases involved input from a Citizen Advisory Committee and the general public. The EQB appointed a 25-member CAC, representing groups involved in the animal agriculture issue. The CAC assisted in the development of the GEIS Scoping Document, published in December 1998, the selection of consultants, the evaluation of the Technical Work Papers, and the development of policy recommendations.

To develop its final policy recommendations the EQB considered those that resulted from the GEIS process, along with information from the Literature Review, the Technical Work Papers, and state agencies involved with animal agriculture. The EQB policy recommendations are:

A. Human health concerns exist without regard to the size of a feedlot operation or species of animal being raised. Therefore, all feedlots and food animal operations need to comply with the regulatory programs that protect human health.

B. The Legislature needs to provide more resources for targeted technical and financial assistance for the permitting, enforcement, and outreach activities by state agencies, and for the implementation of appropriate safeguards by farmers and agriculture-based businesses.

C. State agencies and counties should continue the development and maintenance of GIS data layers and other monitoring and decision tools, which are critical for good siting, expansion, and operation of feedlots. This effort includes the data collection guidance and GIS data that support the sustainable land application of manure. Information needs to be regularly updated to maintain consistency and data quality.

D. County and State feedlot regulatory programs need to continuously evaluate and improve the permitting, monitoring, enforcement, education, complaint management and resource coordination processes to ensure timely and reasonable decisions, effective environmental protection, and efficient coordination between permitting staff and technical and financial assistance providers at the local level to assure the public that regulatory processes are working to protect their health and environment.

E. Prioritize research funding to address the air and water quality impacts of agricultural chemicals, bacteria, pathogens, and antibiotics. This funding should include characterization of the health effects, quantification of the source strength, and determination of the environmental impacts from animal agriculture outputs that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research.

F. Accelerate the work of the Feedlot Air Quality Stakeholders in development and technology transfer of modeling techniques and other practical methods to address odor and air quality issues for siting and management of feedlots, particularly computer model evaluation and development of empirical screening tools. Increased funding for air quality and odor research and incentives for improvement is needed to move forward in an expeditious manner.

G. The EQB should outline a comprehensive agenda for addressing cumulative water impacts, accomplished through study of smaller, relatively homogeneous geographic units, such as watersheds or agro-ecoregions. We encourage exploration of carrying capacities for animal agriculture and other land uses, coupled with a mechanism to monitor regional acreage claimed for applications of manure on a watershed basis..

H. The MPCA, MDA and BWSR should lead the development of a state-sanctioned program using third-party reviews or similar options by which feedlots may be certified as complying with local, state, and federal rules and regulations.

I. In anticipation of the development of TMDLs, the EQB supports additional paired watershed studies that evaluate the impact of existing management practices and the development of additional Best Management Practices (BMPs) on water quality, particularly for reducing fecal coliform, sedimentation and nutrient impacts.

J. The EQB should develop a strategy with other state agencies to continue to advance the understanding and use of the information assembled in the GEIS. Emerging environmental and economic issues surrounding feedlot and manure management should be assigned to the Feedlot and Manure Management Advisory Committee.

K. State agencies, recognizing the importance of local involvement in feedlot siting and land use decisions, should explore ways to enhance coordination of local government planning and zoning efforts related to animal agriculture and provide technical assistance to reduce conflict and duplication of effort. State agencies should promote the use of the innovative land use and conflict management tools by local units of government and assist in making appropriate training available.

L. State agencies and counties should have a goal to promote systems that are both supportive of animal welfare and are economically feasible.

The GEIS Summary Document is a generic, or general, document. It supplies broad information that establishes program policy needs and goals related to animal agriculture. It must be recognized that technology regarding animal agriculture is changing rapidly and thus the information provided in this document may not be the most current on any specific topic evaluated under the GEIS process.

INTRODUCTION

HISTORY

Animal agriculture in Minnesota changed dramatically during the 1980s and 1990s. The establishment of a growing number of large confinement-type animal production facilities fueled an ongoing debate over environmental, economic and health issues that were beyond the scope of individual feedlot permits, Environmental Assessment Worksheets and the authority and expertise of any single unit of government.

Increased animal concentration has also raised questions about the economic viability of smaller operations and small towns and their business and the social structure of rural communities. Feeding operations share the characteristics of other environmental issues: they number in the tens of thousands (ranging from very small to very large); impacts are not always readily apparent; significant scientific uncertainty exists for at least some of the asserted impacts; and environmental regulation is relatively new to the agriculture sector.

Most Minnesotans are familiar with small feedlots – in fact, many grew up on or near one. New, larger operations are unfamiliar. They look different on the landscape, produce more odors and raise new questions about hydrogen sulfide emissions, catastrophic spills and the disposal of large quantities of manure. Also notable is the fact that nonfarmers are increasingly exposed to farming operations as expanding housing developments encroach on farmland.

Animal agriculture issues are not confined to Minnesota. The National Task Force of Extension Specialists surveyed each state about feedlots. Based on responses from 48 states as of June 1999, the survey found:

- Thirty-eight states indicate that confinement animal feedlot operations have caused controversy
- Thirty-nine state have experienced increased incidents of conflict and attention in the media
- Legislation had been introduced the previous year in 22 states
- Nineteen states experienced court action involving concentrated livestock operations
- Sixteen states have new ordinances or policies passed by local jurisdictions
- Swine feedlots, followed by dairy and chicken operations, are the most controversial

Controversy intensified in Minnesota in the 1990s. In 1998, the Legislature considered several proposals, some to expand feedlots, some to restrict them and one to impose a total moratorium on all new feedlots. Legislators opted instead for a proposal put forth by the Governor and several Environmental Quality Board commissioners, with public input, to prepare a Generic Environmental Impact Statement on Animal Agriculture.

The GEIS process was seen as a way to provide a full public examination of the environmental, economic and social issues surrounding large feedlot operations through an open, stakeholder-guided process and to develop objective policy recommendations. The process had several desirable features: it had been used to successfully address issues relating to timber harvesting; it was established in the environmental review rules so that it was predictable; it had considerable flexibility; it guaranteed specific opportunities for public involvement; and, it was to be undertaken by the EQB, which was seen as a neutral agency.

Consequently, the EQB was directed to prepare the GEIS; $1.2 million was appropriated for the initial phase. Additional appropriations totaling $1.7 million were approved in subsequent years.

The 1998 legislation (Minnesota Laws (1998), ch. 366, sec. 86.), directed the EQB to

- Establish an advisory committee of stakeholders to advise on scope and content
- Examine effects on the economy, environment and way of life in rural Minnesota
- Cover the long-term effects of the industry as it exists and as it is changing
- Examine the roles of various units of government

To establish a Citizens Advisory Committee, the EQB solicited public nominations; over 250 were received. From these, the chair of the EQB appointed a 25-member CAC selected from diverse interests to achieve a balance of viewpoints. Each member was asked to name one or two alternates. A list of members and alternates is provided in Appendix D. Because the process was lengthy, several members were replaced, often by an alternate. Two members resigned without direct replacements and a representative from the Minnesota Department of Health was added in 1999. The CAC operated with 24 members for the remainder of the process.

The CAC met monthly from July 1998 through November 2001, usually for two days at a time. Each meeting was conducted by a trained and neutral facilitator from the Management Analysis Division of the Minnesota Department of Administration. The

CAC reached agreement on most important matters by consensus, "100 percent willing to support it, 70 percent comfortable with it."

Members spent many hundreds of hours between meetings reviewing documents and background information. They also attended public comment meetings and toured a variety of livestock operations.

The committee was charged with making key recommendations on the following:

- Draft and final GEIS Scoping Documents (based on public comments), including the topics to address and the specific questions to answer, which would be used to guide all further investigations and documentation.
- Consultants to prepare the literature review on the identified scope topics
- Tasks to fill in information gaps identified in the literature review and the money to be spent on each
- Consultants to perform the identified tasks
- Revisions needed in the draft literature review reports and draft technical Work Papers
- Policy recommendations to be included in the GEIS
- Revisions to the initial draft GEIS chapters
- Final GEIS based on public comments on the draft GEIS

SCOPING THE GEIS

In the summer of 1998, approximately 800 people attended six meetings around the state to offer input on the scope of the GEIS. More than 250 people offered oral comment for the record; 150 written comments were also received. The CAC used this material in preparing the draft scoping document, which was approved by the EQB on September 30, 1998. To solicit public input on the draft, a second series of six meetings around the state was arranged. Of the 300 people who attended these meetings, 70 offered oral comment and 60 submitted written remarks. Working with these, the CAC revised the draft scope into a proposed final form. This was adopted as the official scope by the EQB on December 17, 1998.

The Scoping Document contains objectives for the GEIS

- Develop a basic understanding of animal agriculture in Minnesota

- Identify and assess the environmental, economic, health and social impacts – both positive and negative – associated with animal agriculture as it exists and as it may change, with particular emphasis given to any cumulative effects in the state

- Identify alternative paths for animal agriculture (including the current path) that can optimize the benefits of animal agriculture in relation to the environment, economy, health and way of life in the state with particular emphasis on sustainability

- Seek consensus on the path(s) that Minnesota should follow related to animal agriculture and, as appropriate, develop the recommendations needed to move the state in the desired direction(s)

The Scoping Document also defined 12 topics to be examined, each with a number of questions to be explored.

- Social/community
- Land use
- Role of government
- Industry structure and competitiveness
- Profitability and economic viability
- External benefits and costs
- Water
- Air quality and odor
- Soils
- Manure and crop nutrients
- Human health
- Animal health and well-being

EVOLUTION OF THE GEIS STUDY

Once the scope of the GEIS was set, information gathering began. The first phase of work was an extensive review of available literature on the 12 topics. The EQB requested bids for the work and the CAC conducted an evaluation in order to recommend a consultant or consultants to conduct the literature review. Teams led by University of Minnesota researchers were selected; they presented their findings in a 1,500-page document, the *Literature Review Summary for the GEIS*, which is posted on the EQB Web site at http://www.Minnesotaplan.state.Minnesota.us.

The CAC determined that the literature provided incomplete answers to some of the questions in the scoping document. Recognizing limits to both time and money, the CAC developed a study work plan that was adopted by the EQB in March 2000. At this point the EQB and the CAC had agreed that they would not be able to analyze alternatives as planned and stated in the original scoping document. The work plan called for consultants to conduct a variety of analyses, which were compiled into technical Work Papers (TWP) that included major findings from the literature review and new information published after the 1999 literature summary was prepared.

Several of the original topics were combined during the preparation of the TWPs. The TWPs can also be found on the EQB Web site.

Finally, the CAC commissioned two additional TWPs. The first, a description of animal agriculture, includes information on alternative and sustainable livestock production systems. The second is an inventory of the species and number of animals at all feedlots in each county in Minnesota. This effort was undertaken by the Land Management Information Center at Minnesota Planning, using data from counties and the National Agriculture Statistics Service (NASS.) It is important to note that location data on feedlots is considered confidential by NASS, which reports only aggregated information. The inventory provides the capability to use electronic mapping techniques to investigate the relationship between feedlots and other geo-spatial factors. The LMIC inventory and the GIS tool being developed is one of the most significant accomplishments of the GEIS process.

DRAFT GEIS DOCUMENT

The draft GEIS document contains what was considered to be the most useful and relevant information from the literature summary and the TWPs.

The CAC was unable to define and identify alternative paths for animal agriculture, as directed in the approved project scope. The most information on this topic can be found in the "Description of Animal Agriculture" Chapter and associated TWP. The CAC recommendations presented in this document have been developed without reference to alternative paths.

In August and September of 2001 the EQB conducted eight public meetings around the state to obtain citizen input on the public review draft. More than 300 people gave oral testimony and about 150 written comments were received. The can be found in Appendix B1. The CAC reviewed all comments, incorporating them into the document and adding a recommendation supporting a permanent extension of the existing moratorium on open-air swine manure storage basins to their original 76 policy recommendations. The resulting document, the proposed final GEIS, was presented to the EQB on December 10, 2001. It is also posted on the EQB Web site.

This document, the final GEIS Summary document has been revised to address concerns expressed at the December 2001 meeting. The Final GEIS was determined to be adequate by the EQB in September 2002.

USE OF THE GEIS DOCUMENTS

The primary purpose of this GEIS project is to understand the issues and impacts of animal agriculture in Minnesota at a general level. Therefore, the appropriate use of the GEIS is as a ready source of general information regarding numerous aspects of animal agriculture. The GEIS is particularly helpful concerning non-environmental issues such as economic impacts and social and community impacts, which are seldom addressed in the review of specific projects.

The EQB believes that the GEIS will be useful to many different people or entities in a variety of contexts. The public can use the summary document as a primer on animal agriculture and its effects on the state's economy, social structures, and environment. The EQB hopes that, by expanding public understanding of the effects of livestock farming, the GEIS will contribute to a more rational and less emotional reaction to proposals for new or expanded animal agricultural operations, resulting in better projects and less social friction. Feedlot operators can benefit from GEIS information to better plan and manage their operations and increase their sensitivity to possible concerns of their neighbors. Certain GEIS information may be useful to them in preparing permit applications and any EAWs or EISs that may be required on their projects, or in responding to issues raised by citizen petitions seeking an EAW. Local units of government can benefit from the GEIS analysis of the causes and nature of conflicts over feedlot proposals and the many specific techniques suggested in the GEIS documents for improving ordinances and planning to deal with agricultural issues. Along with state regulators, local units of government can benefit from the GIS-based tools developed through the GEIS process for geographic analysis and mapping of feedlot information. All governmental units and the state legislature can use the GEIS as a source of suggestions for improving how the government regulates and promotes animal agriculture. The possibilities range from minor tweaks to existing programs to major legislative initiatives.

Animal agriculture issues are of widespread interest and much research is underway, therefore information contained in the GEIS may be supplemented, superceded or refuted by new information at any time. Some of the information, such as the science of soil and manure interaction, is well understood and not likely to change. Other information such as that on human health effects is likely to change rapidly as science and technology in this area evolve. The EQB may, from time to time, issue addenda or supplements to the GEIS in order to update or improve its information.

The focus of the Animal Agriculture GEIS study, as directed by the Legislature and fleshed out through the Scoping Document, was on broad, industry-wide issues. The EQB did not contemplate using the final product as a substitute for project-specific environmental review. Future projects must still assess the environmental impacts and their significance based on information specific to the project and its location. This is in contrast to the intended use of the Forestry GEIS, where the primary purpose of the GEIS analysis was to assess the impacts of various timber harvesting scenarios so that the results could be directly substituted into EAWs and EIS on individual forest products projects. The Animal Agriculture GEIS does not, and was not designed or prepared to, contain information that would substitute for site-specific analysis.

Use of GEIS Technical Information in Project-Specific Review
The EQB environmental review program rules, at Minn. R. 4410.3800, subpart 8, captioned "Relationship to project-specific review," give the following directions for the use of GEIS material in project-specific environmental review documents: "Project-specific environmental review shall use information in the GEIS by tiering and shall reflect the recommendations contained in the GEIS if the EQB determines that the GEIS remains adequate at the time the specific project is subject to review."

"Tiering" is defined to be the incorporation by reference of "the *discussion of an issue* from a broader or more general EIS" into a subsequent review document. (Minn. R. 4410.0200, subp. 88, emphasis added.) The use in another document of a particular fact or piece of information found in a GEIS would not constitute tiering. Tiering means the incorporation of the entire discussion of an issue. An RGU is not required to seek a determination from the EQB about the continuing adequacy of a GEIS prior to the use of GEIS information in a manner that does not constitute tiering.

If an RGU intends to use GEIS information in an EAW or EIS by tiering, it may or may not need to seek a prior determination from the EQB about the continuing adequacy of the GEIS, depending on whether the tiered information will be supplemented by additional project-specific information. If the RGU will use the GEIS information as background-type information and provide additional project-specific information and analysis to apply the general principles found in the GEIS to the specific project, then the RGU does not need to seek from the EQB a prior determination of the continued adequacy of the GEIS. However, if the RGU intends that the tiered GEIS information be the sole information provided in the EAW or EIS on the topic in question, then the RGU must first ask the EQB for a determination of whether the GEIS remains adequate as to that information. In short, the question is whether the RGU intends to use the GEIS information as a supplement or as a substitute for information specific to the individual project. If used as a substitute for project-specific analysis, then a prior adequacy determination from the EQB must be sought.

Even if a GEIS is determined by the EQB not to remain adequate for use in tiering, an RGU may continue to use information from the GEIS if in the judgement of the RGU the information used remains reliable; however, the RGU must be prepared to justify its decision to use the information.

Use of GEIS Recommendations in Project-Specific Review
The GEIS recommendations are all directed toward governmental policy and program development, i.e., new or changed policies, rules or laws, improved program effectiveness, priorities for funding, and the like. None of the recommendations is directed toward specific projects and should not be interpreted as applying to a specific project. The reader should not infer that the recommendations must be completed before an RGU can reach an adequacy decision on a site-specific project.

UPDATING THE GEIS

As the GEIS has progressed, it has become apparent that some sort of periodic GEIS update and a policy implementation component needs to be a major recommendation of the Final GEIS. These feedlot issues will continue to be controversial and time-consuming.

Because of the complex and dynamic nature of the animal agriculture industry, it will be important to keep information current if the GEIS is to be considered adequate in the future. This could be accomplished by annual updates or supplements to the Final GEIS Summary document. The CAC identified several elements and made the following recommendations for an updating process. It should:

- Be the responsibility of the EQB
- Have ongoing public input
- Have a smaller advisory group
- Establish a position at the EQB to assist with feedlot environmental review and act as liaison between state agencies and producer and environmental groups
- Periodically update the existing document and report to the EQB and the Legislature on emerging issues
- Work with the Legislature to implement CAC policy recommendations

POLICY RECOMMENDATIONS

The CAC identified policy recommendations for the Minnesota Legislature and the EQB Board, and planned to assign priorities to the recommendations. However, the committee members felt that each policy recommendation was extremely important, and they were reluctant to prioritize the recommendations or split them apart into the technical chapters.

The complete list of 77 policy recommendations can be found in Appendix D. Individual recommendations are also distributed throughout this report, in the relevant technical chapter. While each of the 77 recommendations deals with a particular issue, several cross disciplinary themes emerged. These are:

- **Support communities**: Encourage community involvement and improve dialogue concerning animal agriculture issues to prevent or resolve conflict and identify mutually acceptable alternatives; be responsive to community values, and support local control over land use decisions

- **Improve permit process:** Create a feedlot permit process that identifies and resolves environmental problems, allows meaningful dialogue among affected individuals, is efficient and predictable for all concerned parties, and includes citizen redress and agency enforcement

- **Enforce existing laws and rules**

- **Improve data access:** Develop better data gathering and management, such as the feedlot inventory, permit files and complaint logs, while clearing up conflicts over data availability and privacy.

- **Identify costs and benefits:** Develop a method for estimating the social, environmental, economic costs and benefits of various systems of animal agriculture to the community.

- **Protect resources:** Work to protect water and air quality and human health for the future by addressing related issues while at the same time ensuring the well-being of farm animals.

- **Provide financial assistance:** Provide funding and financial assistance for producers, research and development, and implementation of various GEIS recommendations.

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ANIMAL AGRICULTURE GEIS, CAC POLICIES AND AGENCY PRIORITIES

During the GEIS process, the Citizens Advisory Committee developed a number of policy recommendations based on their interpretation of the information presented in the Literature Summary and the Technical Work Papers. These documents were prepared in response to the study questions developed for the Scoping Document. The 24 member CAC used this common information and their individual experiences and expertise to construct 77 policy recommendations through a process of extensive discussion and debate. Each recommendation required the unanimous consensus of all CAC members. This was designed to prevent any majority or minority faction of the CAC from being able to control future policy direction. However, the unanimous consensus requirement does prevent controversial policies from moving forward. In essence, every CAC member had veto authority on all policies. These consensus policy recommendations are the summation and distillation of the collective wisdom of the CAC and the GEIS process.

POLICY RECOMMENDATIONS

CAC felt that each of the policy recommendations was extremely important. The EQB member agencies insisted on developing policy priorities and separating the policies into appropriate subject areas with supporting information for each policy wherever possible. In addition to collecting and analyzing detailed technical information, throughout the course of the GEIS process, CAC identified policy recommendations for the Minnesota Legislature and the EQB.

The numbers in parentheses following the policy recommendations in this document refer to the original numbering of CAC policy recommendations. The exact text of the CAC policy recommendation is set off in italics and numbered with a "#" sign for easy recognition by the reader. The entire set of 77 policy recommendations is contained in Appendix D at the end of this Final GEIS Summary document for reference.

A number of policies were discussed by the CAC where they could not achieve unanimous agreement, so these appear in the supplementary material on the Final GEIS CD Additional specific technical recommendations proposed by the various expert consultants can also be found scattered in the sections of the Literature Summary and in Technical Work Papers also appear on the CD. EQB member agencies submitted their own policy priorities for inclusion in the document.

The following section provides the CAC policy recommendations along with a short rationale for each, extracted from the GEIS technical documents and discussion that occurred during the CAC meetings. In addition, EQB staff spent considerable time working with Minnesota state agencies to establish their policy priorities and recommendations for additional program and research funding.

REORGANIZATION OF CAC POLICY RECOMMENDATIONS

These topics are presented in the following order:

- Research Needs
    - Human Health
    - Air Quality and Odor
    - Water Quality
    - Nutrient Management
    - Economic Impacts
    - Production Systems and Best Management Practices
    - Conflict Management and Resolution

- Data Management
    - Feedlot Inventories
    - Permit Files
    - Odor Complaints
    - Tracking Systems

- Feedlot Regulation
    - Permitting
    - Interagency Coordination
    - Size Neutral Considerations
    - Manure Management
    - Air Quality and Odor
    - Worker Safety
    - Animal Welfare

- Monitoring and Enforcement

- Funding Needs

- Evaluating Regulatory Effectiveness

- Citizen Empowerment

- State Level Livestock Initiatives

- Federal Level Livestock Policies

Research

In many areas, the result of the attempt to answer the scoping questions was a realization that our current understanding is too limited; further investigation is needed. These research needs are further categorized by the major subject areas in the Scoping document. The state legislature can foster this research and public education through various funding and outreach mechanisms including accessing available federal program and research funds from the 2002 Farm Bill, at the state level by seeking LCMR grants, cooperation with the University of Minnesota Extension Service, and the Agricultural Utilization Research Institute. There was a sentiment expressed that industry sponsored research tended to be less objective than that sponsored by public funds.

More research is required in many areas. The CAC noted this need frequently. Some of the key areas of research focus include air quality, odor, water quality, human health, economic, agricultural pollution control technologies. The Feedlot and Manure Management Advisory Committee group has recently agreed to put together a subcommittee to help identify and recommend ongoing research priorities associated with feedlot operations. In their initial meetings, FMMAC identified air quality and odor, water quality and management and human health effects as their highest priority areas for research funding.

The discussion of research needed is necessarily general in the following section. In determining the distribution of limited research funds a much more detailed description of research objectives and planned experiments would be needed. Such a level of detail would serve no useful function in this portion of the document.

<u>Human Health Effects</u>
We support research to characterize health effects, quantify source strength, and determine the environmental fate of outputs of animal agriculture that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research. (#4)

The Human Health TWP and Air Quality TWP both point out that there are many individual chemicals where the health impact is poorly understood due to limited toxicology, epidemiological, medical, occupational health and environmental monitoring information. We have only rudimentary knowledge of the synergistic and potentiation effects of multiple chemicals on a single organism. It is difficult to prioritize limited resources to control or solve problems without knowing the precise magnitude of effects of the various components. Since there is not enough money to control every factor completely, it is rational to attempt to control the more serious factors first, until some point of diminishing returns was achieved. Independent, unbiased research is needed to help determine answers to these questions.

Accelerate the Minnesota Department of Health efforts to set health-based standards for chemicals. (#6)

This recommendation is suggested by the Human Health TWP and Air Quality TWP, which states that there are many components of concern in air emissions from feedlots. Current air quality monitoring and regulation are based primarily on hydrogen sulfide (H_2S) and ammonia (NH_3) as these are the only air pollutants where established human health risk limits and regulatory control levels for air quality exist. A long-term program of health-based standard setting seems to be the only reasonable means to approach the important, complicated, expensive task that is becoming an increasing concern to members of the public, the medical and environmental communities.

Accelerate the Minnesota Department of Health efforts to set health-based standards for suspect chemicals of concern in surface and ground water in consultation with appropriate federal agencies. (#30)

This recommendation is suggested by the Human Health TWP and Water Quality TWP, which states that there are many components of concern in surface and ground water associated with feedlots. Current water monitoring and regulation is based primarily on Nitrate (NO_3) and Fecal Coli form bacteria, as these are the only pollutants routinely analyzed in drinking water wells. It is widely observed that other suspect chemicals are found in surface and ground water monitoring sample analysis at or near feedlots. Health-based standards seem to be the most reasonable way to help us determine how to allocate limited resources to pollution control and public health protection.

<u>Air</u>

Expand the MPCA ambient air quality-monitoring network to characterize more fully agricultural impacts from feedlot operations. (#17b)

Support increased federal funding for air quality and odor research and incentives for improvement related to feedlots. (#20)

Odors and air emissions are widely perceived as a major nuisance and potential human health problem associated with feedlots. The transient nature of air emissions and odor events makes monitoring and enforcement very difficult. The Air Quality TWP and CAC discussion point out the need for an expanded ambient monitoring network and the desire for wider availability of this information to the public. A real-time complaint reporting and enforcement system would benefit the public, regulators and the regulated industry.

Conduct a detailed inventory of feedlot air quality monitoring and odor complaint data, focusing primarily on the most heavily agricultural counties. (#14c)

One of the tasks of the Air Quality TWP was to conduct an inventory of the air monitoring data and odor complaints received by the Minnesota Pollution Control Agency. The Project Manager of this TWP was a former MPCA Air Quality Division Director, thoroughly familiar with the data and files maintained at MPCA. Even with this advantage, the consultants had a very difficult time locating and correlating all the requested information. Since air quality, odor and the associated health effects seem to be among the highest priorities of the public in regulating feedlots, it seems reasonable to devote additional resources to investigate these questions further. Recent independent research in other states verifies the widespread nature of this concern and hints at previously unsuspected medical effects from odors.

An independent third party should be contracted to assess and characterize existing data that would lead to the development of a statewide emission inventory for air pollutants to facilitate continued surveillance and air modeling of sources. (#16)

Since the public is not confident with the state's management of feedlot air and odor problems, it is reasonable to employ an impartial third party to analyze the data and suggest modifications to the states program..

Encourage/Support the research and development and technology transfer of livestock air quality control technology. (#17a) *Develop alternatives for dealing more effectively with the persistent problems of agitation pump out air quality and odor problems* (#17c)

Previous comments have indicated the importance of the air quality and odor problems from feedlots. Research in technology improvements is a wise investment that may yield great future benefits. The odor problems seem to be the very worst during those brief periods when lagoons are agitated and pumped out. Odor control measures should focus on this critical period.

Conduct a one-time independent third-party audit of the MPCA hydrogen sulfide program and evaluate and implement findings as appropriate. (#18)

Hydrogen sulfide is the single most significant air pollutant given off from feedlots and manure. It has known deadly acute health effects, long-term chronic health effects and significant odor. There is already an existing health risk limit and pollutant concentration limit for this compound. Allegations have been made that MPCA has been negligent in its control of this chemical at feedlots. A third party audit would enable us to address many of these public concerns. Hydrogen sulfide is the best single indicator for the extent and magnitude of odor and air pollution from feedlots.

<u>Water</u>

Support increased federal funding for research to improve water quality and to provide flexible incentives for operational and environmental improvement related to feedlots (CAFO). (#35)

Support paired watershed studies that evaluate the impact of existing management practices and BMPs on water quality. Review results to make recommendations for nutrient handling including adjusting rules and accelerate adoption of BMPs using results from the paired watershed studies. Range of scales studied could be from 20 acres to 10,000 acres this would allow analysis on different levels. (#43)

This recommendation comes from the work in the Water Quality TWP. This type of study would allow scientists to test a number of BMPs to gather critical information on the most environmentally beneficial and cost-effective means of controlling pollution from feedlots. Improved manure management practices and the recognition of the key role manure plays in nutrient recycling were important findings in the Soils and Manure and the Water Quality TWPs. Recently, the Land Stewardship Project sponsored a comprehensive paired watershed study in Minnesota to evaluate sustainable farming practices and various alternatives. This type of work needs to be extended and conducted for the more numerous large conventional livestock systems and on multiple soils, crops and watersheds.

Coordinate the collection of appropriate state, local and federal agencies and non-governmental organizations of surface and ground water monitoring data, continuous improvement in data quality and quantity, field validation and interpretation of data using models as accepted by EPA and/or PCA for water pollution control. Maintain this information in an electronic database with summary information available to researchers and the public. (#33)

Numerous agencies are collecting this type of information. Professionals in the various agencies and nongovernmental organizations do talk and share information among themselves. The public and legislature are generally not aware of how much cooperation is actually occurring. The public is demanding increased access to this information. The use of a common Web site and widely available GIS technology to display this data and enable relatively easy spatial analysis would meet the desires of many members of the public concerned about local and regional water quality issues.

It seems reasonable to consolidate and coordinate data collection and analysis of compatible data to the maximum extent possible. Data quality control and assurance is important to enable comparability and ease of use of data collected by different groups for different purposes. Minnesota citizens and nongovernmental units can also contribute to this pool of data if they follow the appropriate sampling and analysis protocols.

The Board of Water and Soil Resources should review the FLEVAL feedlot water pollution potential model for accuracy, address inaccuracies, and add a section designed to assess potential runoff impacts from land application of manure and chemical fertilizers. (#36)

BWSR has recognized that the original FLEVAL model was not designed for the purposes it is currently being used. BWSR staff has assisted in the technical evaluation of GEIS documents and suggested a number of helpful modifications in the documents. They have offered to upgrade the FLEVAL model to include the effects of manure management as a component in the feedlot evaluation model. This enhancement would greatly improve the utility of the model in conjunction with the new 7020 state feedlot rules.

Research nutrient and pathogen losses to surface tile inlets in manured and chemically fertilized fields under a variety of conditions (e.g., wet weather events, seasonal timing of application, method of application) at times when inlets are likely to be active (snow melt; following rain events). Review research results and to make recommendations for nutrient handling including adjusting rules and accelerating adoption of BMPs using results from the research. (#37)

The Water Quality, Soil and Manure and Human Health TWPs all endorse the idea of optimizing manure application methods to maximize nutrient usage and minimize negative public health and environmental consequences. The Air Quality TWP and the Role of Government TWP recommended that the feedlot rules incorporate flexibility to deal with different regional geology, site circumstances and new technologies. Rather than focusing solely on penalizing violators, the TWP consultants recommends providing flexible incentives to reward and encourage the imitation of those operators who develop innovative means of meeting or staying well below permit discharge limits.

Because the current permit process monitors adequate individual acreage for manure application but no one is currently monitoring the regional aggregate of acreage available for manure application, we encourage exploration of animal density limits or a mechanism to monitor regional acreage claimed for applications on a watershed basis. (#42)

The 1999 Legislative Auditor's Report on Animal Feedlot Regulation found a number of MPCA discrepancies in this area. As the requirements of the new MPCA feedlot rules come into effect, improved manure management planning and record keeping will become ever more significant in feedlot regulation. It will become increasingly important to monitor the cumulative and annual loading of nutrients at permitted fields to make sure that nitrogen, phosphorus and micronutrients are applied at agronomic rates. This objective could be accomplished by requiring individual manure land application site permits and monitoring, although it would be time and resource intensive. Another more empiric approach to this situation is the use of animal density limits as a mechanism to prevent the excess production of manure in a location beyond the capacity of local land to allow for agronomic use of the material. As federal requirements for watershed-based total daily maximum loadings become required in impaired watersheds, manure management will have to be improved to track this potential source of excess nutrients.

Economic Impacts

Develop a method for estimating the economic impact of an existing or proposed livestock enterprise, giving best estimates of the value of positive and negative externalities. (#76)

The issue of externalities is one of the fundamental economic questions of feedlot management. Feedlot pollution and nuisances such as odor are negative externalities that create social and economic strife in many rural communities. Positive externalities from livestock agriculture have also been neglected in most calculations. A rational method of accounting for the true totality of costs and benefits in livestock agriculture would be a useful tool in directing political decisions on feedlots and long-range land use planning. As feedlots spill excess pollutants into the land, air and water, we are seeing the degradation of these common resources to the detriment of all. The strengthening environmental ethic of the public is demanding greater accountability for externalities in return for granting land use privileges.

Fund research to develop and report the external costs and benefits of Minnesota's animal agriculture production and processing. (#71)

Initiate a comprehensive examination of livestock processing industries in Minnesota, identifying the connections between production, processing and social and community impacts. (#64)

It would be useful to complete the balance sheet of all the positive and negative costs and benefits from animal agriculture to make rational decisions on future policies. It is particularly important to use a systems analysis approach that considers the economic multiplier effects of how the system components work together to support or undermine social and economic stability. There is no doubt that livestock agriculture has made many positive economic, social and cultural contributions throughout Minnesota's history.

Production Systems

Encourage and support the research, development, and technology transfer of improved feedlot operations and livestock manure quality control techniques through the University of Minnesota and its Extension Service. (#34)

Research and development of new technology is critical to optimize production and yields for all producers and processors. The University of Minnesota and the Extension Service are cornerstones to this research, public education and technology transfer process. We should also be aware of the valuable contributions to the knowledge base provided by public-private partnership sponsored research.

Encourage the development of alternative agricultural production systems in Minnesota (#72a)

Alternative and sustainable agriculture is an important and growing component of our overall system. Consumers are becoming increasingly interested in organic foods. Incentives and dissemination of research in this area is an important goal to promote long-term environmental benefits. The Department of Agriculture should continue and increase funding of efforts in this area.

Research animal production methods that foster animal welfare. It should be the goal to promote systems that are both supportive of animal welfare and are economically feasible. Basic animal welfare practices should be disseminated widely among educational institutions in the state. (#66)

Perhaps the greatest challenge in evaluating and comparing feedlots is the difficulty of accurately accounting for the real costs and benefits associated with any operation. Economics is fundamentally a quantitative discipline. Certain factors are much more difficult to evaluate than others. Agricultural economics is complicated by subsidies on water, energy and fuel, tax breaks, price supports, set aside payments, difficulties in estimating appreciation and depreciation of assets and material, hidden labor costs and value, and externalities. Those factors which involve external costs and benefits are the most difficult to compute. Until we can quantify all inputs and outputs from a feedlot operation, it is virtually impossible to compare different alternatives fairly. Economists tend to measure the easy factors first and ignore or downplay those items that are difficult to quantify.

Actions needed to implement this recommendation:

1. Establish mathematical computer models that include all operational factors as input parameters, including a standardized set of costs/benefits for externalities.

2. Test the model using existing data from real facilities to develop a standardized measure such as profit per day per animal unit per species, as well as a profit per day per facility daily operating cost. This measure should be independent of facility size allowing one to compare small, medium and large size facilities to help determine optimal configurations for production facilities.

3. Where externalities are involved use estimates of value added or lost to develop a first approximation of economic efficiency related to differences in facility size, type and location. Based on these results, try to determine the appropriate mix of small, medium and large livestock facilities to produce Minnesota's animal products.

Encourage and support the use of "green payments" (payments to farmers linked to use of environmentally beneficial practices) in addition to the present U.S. farm policies, and investigate ways to incorporate this kind of program in state programs. (#73)

Encourage continued antitrust vigilance at the federal and state levels. (#74)

In the public meetings on the draft GEIS the message came through loud and clear. A number of persons were concerned that the GEIS project had not thoroughly evaluated alternative and sustainable livestock production systems. EQB staff tried to locate the information requested with little success. Even proponents of sustainable systems who offered to provide information had little economic data that could be analyzed. There is a strong trend towards advocating these alternative systems for social and environmental values. Reliable economic data is difficult to find through the University of Minnesota or the Department of Agriculture, Sustainable Agriculture Program. The technical writer for the Description of Animal Agriculture was trained as an agricultural economist and worked in the sustainable programs department of MDA and she had difficulty locating much useable information. That information we have on alternative and sustainable systems is primarily anecdotal and located in the Description TWP and the Description of Animal Agriculture chapter of this document.

The growing social and political support for helping small and medium family farmers compete against large firms is highlighting the need for more funding devoted to these policies. Debate over the reform of the Farm Bill is including the need to include social and environmental considerations in farm subsidy programs. Major policy decisions about environmental quality, preservation and protection of land and water resources and the future survival of family farms were dealt with in the 2002 Farm Bill. The trend for consolidation of livestock operations and the integration of production, processing and retail distribution of products justify the concerns about vigilance for anti-trust violations.

Agricultural subsidies and price support programs have tremendous potential to serve as tools of social and environmental engineering, if these can be focused on agreed objectives. Consideration should be given to modifying state and federal cost-share program priorities in Minnesota to move the farming community towards these economically determined optimums.

Establish livestock agriculture friendly zones or preservation regions to promote social stability and minimize economic costs associated with conflicts over facility siting.

Improve responsiveness, local presence, and coordination among state agencies at the most local level through state initiatives and increased funding for staff public education and technical assistance activities.

To support animal agriculture in Minnesota consider the following options:

a. Retain and help facilitate modernization and expansion of existing processing plants

b. Foster opportunities for producers of livestock products to capture value added from further processing and marketing.

c. Offer financial incentives to attract new processing plants competitive with other states.

Develop an efficient, environmentally-sound, community and producer-friendly, permitting process that supports, enhances, and attracts processing facilities. (#62)

Real farmers who came to the public meetings had one fundamental message, "It is all about economics." The largest single concern we heard repeatedly was that farmers are being squeezed to survive on smaller and smaller profit margins. Prices seem to be stagnant as costs of doing business continue to rise. Environmental costs of permit data collection and ongoing facility monitoring are widely regarded as excessive and unnecessary. Farmers are very concerned with what they perceive as the rapid pace of rule changes and uncertainty in the time and expenses needed to obtain operating permits. Many facilities rely on credit to finance their operations. Uncertainties in obtaining permits translate into difficulty in obtaining operating credit. Farmers want a more standardized streamlined system for dealing with regulators. The policy recommendations following were crafted with the objective in mind.

Feedlot regulation should be primarily delegated to counties with environmental oversight and technical assistance functions provided by the Pollution Control Agency. Feedlot promotion, collection of operating economic data and promotion of sustainable systems should be provided by the Department of Agriculture. Coordination of cost-share funding, and prioritization of remediation should be provided by the Board of Water and Soil Resources acting in concert with local Soil and Water Conservation districts.

The County Feedlot Officer shall act as a central clearing house for regulatory functions, technical assistance and cost-share subsidies as well as working with the University of Minnesota Extension program to facilitate public outreach and education efforts. Improve responsiveness, local presence, and coordination among state agencies at the most local level through state initiatives and increased funding for staff activities.

Conflict Management

Evaluate the effectiveness of conflict resolution applications and disseminate findings. (#45)

While there is not a formal examination of the effectiveness of all the various techniques of conflict resolution provided, a list of useful techniques has been given for consideration. The Land Use TWP explores many of these techniques in some detail. It also provides a theoretical conflict resolution prediction index that may have use in certain situations. The Land Use TWP and the Role of Government TWP both suggest the formation of a feedlot conflict resolution intervention team to assist with resolving these situations outside of the court system or zoning authorities. This team should have a permanent membership of individuals with relevant expertise. It would be supplemented in each case by a number of local members who understand the political and regional considerations of the individual situation.

Explore and evaluate conflict management tools to address conflict situations. Make these tools available for use by and at the direction of local units of government. (#47***)***

Encourage the exploration and evaluation of innovative planning policies and land use techniques such as:

a. Agricultural Tiered Zoning (ex. Ag1, Ag2 and Ag3)

b. Agriculture Preservation Districts

c. Setbacks based on the OFFSET setback distance estimation model developed by the University of Minnesota, or equivalent tools for facility planning and design

d. Notification of potential new residents of possible nuisance conditions from normal agricultural operations

e. Purchase and/or transfer of development rights

f. Buffer zones around environmentally sensitive features

g. Promoting livestock friendly zones

h. Relocation of feedlots away from in designated environmentally sensitive regions

i. A process for local road authorities to grant odor easements on public roads adjacent to feedlot operations. (#48)

The Land Use TWP and the Role of Government TWP explored the interactions between various citizen groups, levels of government and overlapping technical regulation of feedlot siting and operations. The Land Use TWP tended to look at local and county issues. The Role of Government TWP examined state, federal and international issues. Both TWPs stressed the need for improved communications among the various stakeholders and authorities.

Data Collection/Tracking

<u>Feedlot Inventories</u>

The legislature should fund and require completion of a Level 3 inventory of feedlots for each Minnesota county. The inventory should include FLEVAL analysis for all open lots, *and identify potential CAFOs (confined animal feeding operations, as defined by the U.S. EPA).* (#26)

As part of the Animal Agriculture GEIS, EQB worked with the Land Management Information Center on an extensive feedlot inventory project. Detailed information obtained from counties where Level 2 and Level 3 inventories existed enabled EQB to conduct many useful spatial analyses in those areas. In those areas where these higher-level inventories were not available, the quality of spatial analyses possible was much less. Many of the goals of all parties involved with feedlot management and operation would be better served if this higher quality feedlot information was available for all Minnesota counties and the inventory was periodically updated. The legislature should consider providing additional funding or incentives to encourage all Minnesota counties to have Level 3 inventories. LMIC worked with the MPCA to incorporate their 2001 feedlot registration data into the feedlot inventory to improve spatial analysis capabilities.

In addition to the feedlot inventory effort, key state agencies, especially the MPCA, MDA, BWSR, MDH, DNR, MGS and the University of Minnesota, have a great deal of internal monitoring and operational data in their permit and project files. Those state agencies do not have adequate funding to analyze, correlate and publish that information for use by the public. The legislature should consider providing additional agency funding for the specific purpose of feedlot data collection and analysis, with the intention of increased public education on feedlot issues.

BWSR should revise the content of its guidebook for Level 3 inventories to address storage and land application of manure. (#38)

BWSR has recognized the need to update this guidebook in light of changing technologies and the new feedlot rules. The BWSR representative to the CAC's Inventory Design Team has expressed the willingness and ability of that agency to undertake these revisions and update the documents to reflect rule and program changes.

<u>Permit Files</u>

Recommend that the MPCA and delegated counties keep complete permit files, including summary statistics. Information considered public should be available without violating public data and/or privacy statutes. (Make recommendation to integrate information between levels of government. Further, need to address the proprietary, private and public data issues.) (#55)

There is a strong public perception that MPCA is unwilling or unable to provide requested data or to respond to citizen complaints in a timely fashion. The value of electronic files and Web pages to provide greater access to public information on feedlots could do much to dispel this perception. Cooperation with delegated counties is a critical aspect to achieving this objective.

Improved transparency of MPCA feedlot operations to the public is likely to increase goodwill for the program and enhance understanding of the limitations of staff and resources.

Odor Complaints

Develop a central and accessible database to log complaints, responses, findings and resolution data, using objective testing tools with standardized protocols. (#14b)

Improve the quality and quantification of complaint information on feedlot operations. There must be consistent reporting formats, as well as comprehensive collection of all complaints. Complaint investigations conducted by counties and the state should be compiled into one electronic database. Additional complaint information should be documented, and include such information as the responding agency, nature and location of complaint site, and complainant and resolution of complaint. (#44a)

Reform the odor complaint process to respond more expediently and require documented notification to the facility owner that a complaint has been received. (#14a)

The facility against which the complaint is lodged should be notified of the information immediately, subject to all the restrictions of the Data Privacy Act. (#44b)

Facilitate and encourage independent standardized third party evaluations of feedlots that have confirmed odor events to customize site solutions to remedy the underlying problems. (#15)

The Air Quality TWP examined MPCA's odor complaint system and found a number of discrepancies in the existing system. Several CAC policy recommendations relate to this area of concern. Discussion of the odor complaint issue is also found in the Land Use TWP, Social and Community TWP and the Human Health TWP. There is no doubt that this is one of the core issues to feedlot management. Improvements in the odor complaint process and the wider availability of public data in this area would help ease substantial citizen concerns. Consistent reporting and response to odor complaints and an attitude of increased customer service could definitely improve MPCA's public image . The MPCA has already begun to improve its complaint data management system.

Regulation

Permitting Process

Develop an efficient, environmentally sound, effective, feedlot permitting process that enhances and attracts livestock production. (#69)

Develop an efficient, environmental-sound, community and producer-friendly, permitting process that supports, enhances, and attracts processing facilities. (#75)

Uncertainty in the feedlot permitting process is a source of continuing anxiety to many people. Changes in the feedlot rules do address many of these concerns, however it will require years of operational data under the new rules to see how effective these modifications will be. Continuing tension between the different local, state and federal governments over feedlot regulations also create transboundary issues that need to be resolved. Producers are particularly concerned that permits be processed within agreed timelines to enable them to plan operations and obtain facility financing.

Improve Regulatory Coordination

Recognizing the importance of local land use involvement in feedlot siting and conditional use provisions, explore ways of enhancing coordination of local government planning and zoning efforts relating to animal agriculture to reduce conflict and avoid duplication of efforts. (#49**)**

Improve responsiveness, local presence, and coordination among state agencies at the most local level through state initiatives (#61a)

Determining the appropriate role of government, separation of powers and avoiding unnecessary duplication are major public concerns when dealing with feedlots. Overlapping authorities and differing objectives and priorities create a great deal of public concern and confusion over who is and who should be doing what and when data needs to be shared. Improved communication and coordination of common efforts could help minimize this problem.

Size Neutral

Human health concerns exist without regard to the size of a feedlot operation or species of animal being raised. Therefore, all feedlots and food animal operations need to comply with the regulatory programs that protect human health. (#7a**)**

The fact that environmental problems are not strictly dependent on operation size creates a number of difficulties in managing the entire system. While catastrophic failures at large facilities create headlines, small problems at numerous smaller facilities can add up to an even bigger long-term problem. The extent of environmental problems is more a function of the quality of facility management than strictly the size of the facility. The strict application of environmental standards to smaller facilities is likely to create disproportionate hardship on facilities least able to afford the costs. While this is offset somewhat by the availability of additional cost-share funds for environmental upgrades, it is likely to cause increasing consolidation of operations and the loss of smaller , less profitable farms.

Water/Manure Application

The Legislature should provide guidance and resources to develop a coordinated watershed-based approach, which includes and encourages local water plans, to address non-point source pollution issues. (#58)

Develop a strategy and prioritize mitigation activities to move towards compliance with TMDL's (total maximum daily loads) in impaired watersheds. (#41)

Require all facilities with greater than 100 animal units at any time during the year, to prepare complete manure management plans (#27a)

Require smaller size operations (between 50 and 300 animal units) to prepare and follow a manure management plan. (#31***)***

Increasingly, watershed basin management is seen as the most reasonable approach for deal with land use and water pollution problems in a hydrologically connected region. The findings of this GEIS, especially the Water Quality TWP and Soils TWP support the wisdom of further movement towards watershed-based management of feedlots. TMDL's, animal density limits and increased focus on manure management plans are all aspects of implementing the watershed-based solution. Effective manure management is the single most important aspect of feedlot regulation in the opinion of many technical experts.

Nitrate is the most common contaminant in Minnesota's groundwater. Best management practices should be required for land applications of manure and commercial fertilizer to protect all drinking water supplies. (#10)

(Require) manure management plans, including an estimate of the quantity of manure generated annually and farm land potentially available for manure application at agronomic rates for the crops and soils present. These plans should be kept on site and available to authorized officials for inspection upon request. (#27b)

BMPs should be implemented for all land applications of manure and commercial fertilizer (nutrients) to protect drinking water supplies. (#32)

Develop and require the use of the Minnesota Phosphorus Index to determine appropriate manure and chemical fertilizer (nutrients) application rates based on the P needs of a particular crop on a particular soil type. (#25)

County and state feedlot inspection programs should include monitoring for compliance with nutrient management plans and with other land application requirements. (#39)

The preceding five policy recommendations all point to the need for better manure management. This finding is strongly supported by the research in the Soil TWP and the Water Quality TWP. Improper manure management is a major source of surface and ground water pollution. Improvements in manure management are one of the single most important innovations in the new feedlot rules.

<u>Air</u>

Maintain state ambient air quality standards for H2S emissions (#21a)

Require air quality evaluation and/or mitigation (surface area and odor analysis) on new construction or expansion of outside open liquid manure storage. (#22)

Encourage the utilization, continuous improvement and field validation of all applicable air emission and air dispersion models as accepted by EPA and/or PCA to develop tools to deal with air pollution control. (#12)

Encourage the utilization, continuous improvement and field validation of applicable computer programs and models, such as OFFSET, which can aid in predicting appropriate operational practices, setback distances and odor levels. (#13)

Require feedlots siting new operations or expanding existing facilities to use the OFFSET model or similar odor setback evaluation tool to aid in designing the facility to minimize off-site odor impacts on potential receptors from manure storage units. (#17c)

The issue of air quality monitoring and modeling is enormously complex and controversial. Current models for odor dispersion and air emission of air contaminants from feedlots are in their infancy. Industrial facility models are more highly developed, but require far more monitoring and background data than is typically available for feedlots. A great deal of additional work is needed to improve the utility of existing models. Research work funded by the GEIS with the MPCA at Hancock Pro Pork EIS and also at the University of Minnesota on extending the OFFSET model were small steps towards beginning to resolving these problems.

<u>Worker Safety</u>
Encourage worker safety plans for feedlots. (#9)

Feedlots and livestock processing facilities are among the more dangerous workplaces in the United States. In the past, these workplaces have been largely excluded from OSHA regulation. These areas should be a future priority for occupational health inspections and enforcement activity.

<u>Animal Welfare</u>
Establish humane codes of practice for Minnesota animal agriculture that reflect scientific knowledge and public concerns regarding the health and well-being of agricultural animals. (#65)

While existing Minnesota law does prohibit excess cruelty to farm animals, concern is expressed that these laws are rarely, if ever enforced. There is a major public movement of increasingly concern for issues of animal welfare. Recent decisions by large retail restaurants to require changes in livestock handling practices to improve animal well-being point out the extent of consumer feeling on these issues. Many advocates for animal rights see the policy recommendations of the GEIS as positive steps but not nearly enough to address the problem adequately.

Monitoring/Enforcement
The MPCA and its delegated county partners should conduct periodic inspections of feedlots. Given the large number of facilities, the inspection program should be targeted to the riskiest operations and the most sensitive locations first. (#57)

If a complaint investigation validates the probable exceedance of health standards by emissions or discharges to the environment, the operator must show compliance through continuous monitoring or mitigation. (#8)

Improve enforcement against long-term non-compliant facilities. (#21b*)*

Strengthen and improve enforcement efforts against long-term non-compliant facilities. Identify and vigorously pursue legal actions against feedlot owners and/or operators who have been consistent "bad actors" with a pattern of repeated violations of environmental or public health standards. (#29)

Improved enforcement is an underlying theme that continues to be cited in feedlot discussions. The Legislative Auditors report on feedlots noted the fact that staff limitations prevent MPCA from conducting adequate inspections. There is a wide perception that the existing laws and rules are rarely enforced. This perception creates a culture of knowing violators which gives all livestock facilities a bad name. While MPCA has had a few well-publicized feedlot enforcement cases, the long time lags between discovery and remediation and relatively minor penalties imposed convey the strong impression to the public that this is a low priority for MPCA and county authorities. The need for new compliance tools such as ticketing authority may be needed to augment the administrative tools currently available for prompt action to be taken.

Funding
Regulatory Activities
Additional state financial resources will be necessary both for the permitting and enforcement agencies (#7b*)*

Increased funding for staff activities. (#61b*)*

Assistance for Producers
(State Financial resources will be necessary) for the implementation of appropriate safeguards by farmers. (#7c)

Make the cost incurred to comply with the Phosphorus Index and improved nitrogen management for land application eligible for cost share funding under programs administered by BWSR, MDA, USDA and MPCA. (#24)

Increase funding and information on programs assist small and mid-size producers to fulfill environmental stewardship responsibilities. (#62***)***

The lLegislature should fully fund cost-share needs at the historic contribution ratio, or $8.1 million per year, less federal contributions, and lobby for federal EQIP (Environmental Quality Incentive Program) contributions. If this does not occur, 1) a strict ability-to-pay eligibility criterion should be imposed; 2) the grant ratio should be reduced and the Ag Loan programs increased; and 3) only those practices with the highest benefit to cost ratio should be eligible for cost-share. (#40)

There are many areas where additional funding is needed. The legislature will have to decide if any of the requests for money are adequately justified in light of the other priorities they must be concerned with throughout the state. Money available from the federal 2002 Farm Bill can be used to supplement funds available for state feedlot programs.

Stakeholder/Public Engagement

Explore with producers, community leaders and other stakeholders ways to produce livestock that (1) demonstrates the connection between livestock and community viability, (2) respects neighbors and the community's quality of life, and (3) protects the environment. (#59)

Initiate discussion groups, policy seminars, and conferences for producers, community leaders, policy makers, and other state and local stakeholders, where the many issues of livestock expansion can be discussed and mutually acceptable alternatives or options developed. (#60)

Make a greater effort to inform the public about the public health implications associated with disease occurrence, disease transmission, and antibiotic resistance from animal agriculture. Information about steps being taken to protect public health by farmers, processors, industry groups, government, as well as research by academic institutions, industry organizations and government, should be better publicized. (#1)

Promote public education on the responsibilities and limitations of each level of government (local, state, and federal) in regulating feedlots and handling complaints. Inform citizens of lawful methods of redress available in dealing with conflict over feedlot operations and management. (#46)

Citizen empowerment has created a more knowledgeable and politically active populace. Feedlot operators and units of government must recognize this reality and continually take steps to involve the public earlier and more completely in permitting, zoning and environmental review decisions. The public is becoming increasingly sophisticated and knowledgeable about their rights and the scientific information involved in the debates. One result of this trend is that the process necessarily becomes lengthened and more complicated. Issues of differing values and opinions will continue to dominate the public debate over feedlots. The GEIS and increased public education serve the long-term goals of informing the debate and discussion on issues of fact.

Tracking Systems

National systems need to be developed and implemented to track antibiotic resistance in animal agriculture outputs and to track other diseases that can be passed between animal and humans, including surveillance of such diseases in farm and food industry workers. (#5)

Encourage development and implementation of innovative approaches in food safety and quality assurance, which provide product traceability, higher value and higher quality in food products. This will allow producers and feed providers to identify the source of animals and animal feed in the event of an outbreak of disease. (#11)

Improvements in information technology give us far more power to track data, analyze trends, develop knowledge and communicate quickly with the public. Increased quality assurance and quality control in food production and processing provides greater consumer confidence in the products.

Evaluate Regulatory Effectiveness

The EQB should annually monitor and report on effectiveness and applicability to Minnesota of other states and countries feedlot air and odor regulatory and other activities and make appropriate recommendations. (#19)

The EQB should monitor and report bi-annually on the effectiveness of the states/countries' feedlot water quality activities and applicability of these practices to Minnesota's situation. EQB shall periodically make appropriate recommendations, as directed, to Minnesota state agencies and the legislature to revise and improve our state program based on these findings. (#28)

Periodic self-examination and independent auditing can provide useful insights into areas where the program is succeeding or in need of modification.

State Initiatives to Support Animal Agriculture

In many cases, the state can take unilateral actions to affect positive changes within its jurisdiction. The policies suggested in this section are items that the State of Minnesota could do to improve the regulation and operation of feedlots, while not causing undue negative impact . As a state, we should be constantly searching for successful approaches or techniques being used by other U.S. states, Canadian provinces, European or other countries that could potentially be implemented here to improve our situation.

To support animal agriculture in Minnesota consider the following options:

a. Retain and help facilitate modernization and expansion of existing processing plants. (#70a)

b. Foster opportunities for producers of livestock products to capture value added from further processing and marketing. (#70b)

c. Offer financial incentives to attract new processing plants competitive with other states. (#70c)

Working with producers, establish and promote marketing alternatives for small-sized producers and those not engaged in contract production. (#63)

Support beginning farmers, assist transitioning farmers and coordinate production and marketing systems for producers. (#72b)

Encourage the formation of a comprehensive proactive, and voluntary agricultural pollution prevention program, which ensures that participating producers use effective land stewardship practices that comply with local, state and federal regulations. Certification of feedlots would be included. (#23)

Develop voluntary certification programs that include basic animal welfare standards. Encourage and facilitate marketing of the products of such programs. (#67)

The state should consider farmer and farm worker certification programs to ensure that the people responsible for animal care understand the basic principles of animal biology and behavior. (#68)

Encourage and support the use of "green payments" (payments to farmers linked to use of environmentally beneficial practices) in addition to the present U.S. farm policies, and investigate ways to incorporate this kind of program in state programs. (#73)

The state should provide more training for feedlot officers and local government staff on the environmental review process. (#56)

Federal Policies

There are a number of issues where state and/or local regulation is insufficient. The policies suggested in this section are items that the State of Minnesota could not do without potentially causing negative impact on Minnesota farmers. As world commerce and trade expands, there are more and more aspects of this complex adaptive system that must be managed by coordinated policies at every level of government. Certain areas of livestock regulation involve transboundary issues that cannot be solved by unilateral actions at the state level.

Encourage continued antitrust vigilance at the federal and state levels. (#74)

We recommend that the federal government publicize and enforce the existing ban on the use of ruminant carcasses and offal in animal feeds to minimize the BSE (Bovine Spongiform Encephalopathy) transmission threat in the US. (#3)

Support a comprehensive national program to promote the judicious use of antibiotics for both human health and animal health. The priority use of new classes of antibiotics should be limited to human use. The sub-therapeutic use of antibiotics as a growth promoter in animal agriculture should be reviewed and phase-out considered where science has provided adequate supporting research. (#2)

Agency Priorities - MDH, MDA, MPCA, BWSR

These four agencies, which have members on the Environmental Quality Board, have the most direct involvement with feedlots and associated issues. The first three agencies provided senior staff as representatives or alternates to the CAC throughout the GEIS process. BWSR provided intermittent representation at several key points in the process and reviewed technical aspects of a number of documents. Since these agencies are charged with carrying out feedlot regulation and support activities, their perspective on policy changes and program priorities was solicited for this document. Members from these agencies all provided a great deal of guidance and constructive criticism during the entire GEIS process. All the agencies provided detailed technical comments, corrections and clarifications, these agencies collaborated to help draft the proposed EQB priorities that are found near the beginning of this document . All original agency letters with detailed comments and supporting discussion of their policy priorities are found in Appendix E of the GEIS Summary document.

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Animal Agriculture in Minnesota

The chapter contains a review of the recent major trends in animal agriculture, focusing mainly on the 15-year period from 1982 to 1997. It concludes with a discussion of issues and opportunities raised by the changes taking place in animal agriculture by species. It is based closely on the Description of Animal Agriculture Technical Work Paper (TWP), which uses the GEIS technical Work Papers and chapters of the Literature Summary as the primary sources of information. A great deal of detailed information can also be found in the Description of Animal Agriculture TWP.

Data is primarily from the USDA Census of Agriculture, which occurs every five years, in those years ending in 2 and 7. For this reason the 15-year time span of 1982 to 1997 was chosen for examination. Most of the data was originally compiled from the census database by the Land Use TWP team, and much of the text was adapted from the Land Use Conflicts and Regulation TWP.

The reader will note that county-based data on poultry is lacking. This is due to federal data confidentiality rules designed to assure that agricultural census data does not disclose information on individual operations. Data is suppressed when one farm has 60 percent or more of the total animals of that species in the county. As a result, in the 1997 USDA Census of Agriculture poultry data, 67 of the 87 counties in Minnesota were suppressed. Poultry information is included wherever possible.

Geographic distribution of farms

Farms are located mainly in a crescent-shaped agricultural belt around the western and southern perimeters of Minnesota, and are most concentrated in the central and southern parts of Minnesota. In 1997, Stearns County had the highest number of farms in Minnesota with 2,062, followed by Otter Tail (1,499), Morrison (1,075), Fillmore (1,053), Redwood (1,041), and Goodhue (1,027) counties. Except for Otter Tail, these counties were also among those with the highest density of farms.

Number of farms decreasing

The number of farms decreased significantly between 1982 (66,966 farms with over $10,000 in gross sales) and 1997, (47,281 farms with over $10,000 in gross sales), a decline of 29 percent. All counties lost farms between 1982 and 1997, with the exception of Itasca and Ramsey counties that had minuscule increases. Central Minnesota and the Red River Valley in northwestern Minnesota had the largest percentage decreases.

Average farm size increasing

The average farm size in Minnesota in 1997 was 486 acres. Average farm size was highest along the northwest edge of Minnesota. Kittson County had the highest average farm size at 1,317 acres followed by Wilkin and Polk counties, where average farm size was also over 1,000 acres. The county in the agricultural zone with the lowest average farm size was Stearns, at 273 acres, Wright (278 acres) and Benton (296 acres).

Average farm size in Minnesota increased by 23 percent from 1982 to 1997, from 374 acres to 486 acres. Outside of the seven-county metro area, average farm size increased in all counties except Cook between 1982 and 1997. Increases in average farm size were highest in the central and south central counties, with increases from 40 percent to 63 percent. Some counties that gained the most in average farm size were also those that lost the highest percentage of farms between 1982 and 1997.

Change in farm size can be seen in more detail by looking at the number of farms in various size classes. The most dramatic change between 1982 and 1997 was in the farms that had from 100 to 259 acres. The number of farms in this class decreased in every county during this period, and in many counties, it decreased by 50 percent or more. This is especially striking considering that in most counties this was the predominant farm size in 1982.

Similarly, the number of farms with 250 to 499 acres decreased in all counties between 1982 and 1997. In several counties, the number of farms with 500 acres and up increased while the total number of farms in the county decreased.

Farm operators working more days off farm

Farm operators across Minnesota are increasingly engaged in off-farm employment; it seems that farming is becoming a part-time occupation. A farm operator is a person who operates a farm, and may be the owner, a member of the owner's household, a hired manager, a tenant, a renter or a sharecropper. Each farm has only one operator who reports information. In 1997, 50 percent of farm operators reported no days worked off farm, a 38 percent decrease from 1982. Similarly, the number of farm operators reporting farming as their principal occupation fell by 37 percent statewide between 1982 and 1997. The counties with the highest percentage of operators reporting no days worked off farm relate strongly to counties with a relatively high proportion of dairy farms.

Increased numbers and acres of farm corporations

The number of farm corporations has increased in Minnesota since 1982, at the same time that total farm numbers have declined. (The section on business organization options in the economics chapter explains the various forms of organization a farm may take in Minnesota.) In 1982, there were 57,481 sole proprietorships, 1,323 family farm corporations, and 148 nonfamily farm corporations in Minnesota. By 1997, this had changed to 40,150 sole proprietorships, 2,007 family corporations, and 186 nonfamily corporations. This shows changes of -30 percent, 52 percent, and 26 percent, respectively.

The vast majority of farms in Minnesota are still organized as sole proprietorships. In 1982, sole proprietorships made up 86 percent of the farms, family farm corporations made up 2 percent, and non-family farm corporations made up 0.2 percent. By 1997, this had changed to 85 percent, 4 percent, and 0.4 percent. While family and nonfamily corporations make up a small percentage of all farms, the rate of change in the percentage of farm corporations has been dramatic; this may be an indicator of future trends.

Average age of farm operators stable

The average age of farm operators in Minnesota has stayed roughly the same. It fell slightly from an average of 48.9 years in 1964 to 47.2 in 1982, and increased just slightly to 51.2 in 1997 according to Table 1: Historical Highlights, Minnesota State and County Data, 1997 Census of Agriculture.

Number of livestock farms and animals

In 1997, Minnesota had 41,563 livestock operations. Livestock were found on over half (57 percent) of all farms in Minnesota in 1997. Beef were found on 29 percent, dairy cows on 13 percent, and hogs on 10 percent of all farms. Poultry was found on less than 5 percent of all farms in Minnesota. Statewide, there were 0.39 beef farms, 0.18 dairy farms, 0.14 hog farms and 0.06 poultry farms per thousand acres.

Beef operations were more prevalent than any other type of livestock operation in 1997, at slightly more than half, or 21,310 in Minnesota. Dairy and hog operations numbered 9,603 and 7,512 operations, respectively. Poultry operations made up less than 10 percent of the livestock operations in Minnesota, with just 1,964 layer/pullet operations, 621 broiler operations and 553 turkey operations.

Interestingly, looking at numbers of animals statewide shows an almost perfectly reversed pattern to the numbers of livestock operations. Almost all livestock in Minnesota were poultry in 1997. Broilers had the highest numbers, comprising close to 43 percent of all animals in Minnesota, at 28,456,532. This was followed by turkeys at 16,220,257, and layers and pullets at 13,047,875 which made up 25 percent and 20 percent of all livestock, respectively. Hogs, beef cattle and dairy cows combined made up just 12 percent of all livestock. There were 5,722,460 hogs, 1,271,532 beef cattle, and 1,123,924 dairy cows. The dairy number includes milking cows, dry cows and replacement heifers.

Geographic distribution of livestock farms

In general, beef operations are located more heavily in the far southeast and far southwest parts of Minnesota, dairy operations are located in southeast and central regions of Minnesota, hogs are located in south central, and poultry is located in central Minnesota.

Beef. Thirty counties reported beef cattle on over one-third of all farms in 1997. These 30 counties generally either ran in a band from far southeast Minnesota to central Minnesota to northwest Minnesota, or were located in far southwest Minnesota. The highest percentage of beef farms was found in Houston and Fillmore counties in the far southeast, and Pipestone and Rock counties in the far southwest. Mille Lacs and Pine counties also had high percentages of beef farms. In these counties, beef operations made up between 38 percent and 47 percent of all farms. The largest beef operations, as based on beef cattle per beef operation, are concentrated in southwestern Minnesota. Smaller sized operations with an average of four to 47 cattle per operation tend to be clustered in a band of counties from the southeastern part of Minnesota, up through the central region and into the northeast.

Dairy. Seven counties had over one-quarter of all farms with dairy cows on site in 1997, and two counties (Winona and Stearns) had dairy cows on more than one-third of all farms. Counties with the highest percentage of dairy farms per total farms were located in southeast and central Minnesota. The size of dairy operations is variable across Minnesota in a pattern that is not as pronounced as that for beef and hogs. There are many counties in northwestern Minnesota that have 119 to 199 dairy cows per operation on average. The majority of counties elsewhere in Minnesota have between 83 and 118 dairy cows per operation on average.

Hogs. Counties with the highest concentration of hogs as a percentage of total farms were located in the south central and southwest parts of Minnesota. In these counties, between 21 and 27 percent of all farms had hogs. The geographic distribution of hog operation sizes shows the strongest regional pattern of all species. The counties that have the largest hog operations are in south central and far southwest Minnesota. The counties with the largest hog operation sizes were Martin, with an average of 2,173 hogs per operation; Renville, with an average of 1,639 hogs per operation; Rice, with an average of 1,561; Pipestone, with an average of 1,557; and Blue Earth, with an average of 1,502. These five counties have much larger operation sizes than the Minnesota-wide average of 762 hogs per operation. Counties in a band running from central Minnesota to northwestern Minnesota have the lowest hog operation sizes, with an average of up to 152 hogs per operation.

Number of livestock farms decreasing

The number of Minnesota farms with livestock is decreasing, across all major species (hogs, dairy, beef and poultry). Between 1982 and 1997, the number of farms with layers and pullets and those with hogs declined most precipitously; those with beef had the least dramatic declines. These changes are fairly constant across Minnesota. The number of hog and dairy farms decreased in all counties, and the number of beef farms decreased in all counties except six. County data is not available for poultry due to data suppression.

The percentage of Minnesota livestock farms is decreasing across all major species, with the exception of beef. Between 1982 and 1997, the percentage of layer/pullet farms and hog farms declined most drastically with decreases of over 50 percent. The percentage of turkey farms showed the least dramatic decrease. The percentage of beef farms actually stayed the same. The percentage of hog farms and dairy farms declined in all counties, whereas the percentage of beef farms increased in 33 counties.

Number of animals per farm increasing

The number of animals per farm is increasing dramatically in Minnesota. Between 1982 and 1997, increases in animals per farm were most dramatic in turkeys, layers, pullets and hogs, all of which increased by over 200 percent. The exception to this is beef, where the number of beef cattle per beef farm stayed approximately the same.

In 1997, the largest operations were in broilers, with an average of 45,824 birds per operation. This was followed by turkeys, which averaged 29,331 per operation. Layers and pullets had significantly smaller size operations, at 6,644 birds per operation, but this number was still significantly higher than operation sizes for beef, dairy and hogs.

Of the other three species, the largest operation were swine with 762 hogs per operation on average in 1997. Dairy operations were smaller, with an average of 117 cows per operation (including milking cows, dry cows and replacement heifers). Beef operations were by far the smallest, with just 60 beef cattle per operation.

Converting numbers of animals to animal units paints a less dramatic picture. Animal units are a way to compare numbers and manure impacts of animals across species, a beef cow that is set at 1.0 animal unit.

In order to determine animal units, the average numbers of animals per farm were converted to animal units based on Minnesota Pollution Control Agency definitions, and then averaged across different sizes of animals within the same species. This may not be an entirely accurate way to represent the number of animal units, since it is likely that there are more animals of various sizes on an operation than others (for example, more finishing pigs than sows). However, it provides an estimate of animal units for the sake of comparison.

This showed that again, broiler operations were the largest, at approximately 626 animal units per operation, followed by turkey operations, with approximately 337 animal units per operation. Hog operations were next, with approximately 190 animal units per operation, followed by dairy, with 97 animal units per operation, and layer/pullet operations, with 91 animal units per operation. The lowest operation size again was beef, with approximately 46 animal units per operation.

Consolidation has occurred in all species, both in terms of fewer livestock farms and greater numbers of animals per farm. This is especially true for hogs, dairy and poultry, although poultry consolidation started earlier in the 1970s.

Developments in animal agriculture production and marketing

Development and increased use of confinement systems

Prior to the 1960s, practically all livestock were raised in some type of outdoor system. In the late 1950s and early 1960s, indoor confinement systems were developed. These provided producers greater control of the environment that housed their livestock. Indoor confinement systems address many of the challenges associated with outdoor production systems. Increased animal density allows one person to care for more animals than was previously possible. More uniform production of livestock can occur year round with a reduced seasonal influence. Production flow can be scheduled and tightly controlled to increase biological efficiency. The increased biological and labor efficiency allow indoor confinement systems to be profitable despite the high capital costs of constructing environmentally controlled barns. In addition, stock persons and their animal are indoors and not exposed to bad weather in winter and spring. However, they are also indoors during the summer and fall.

By-products, such as manure, urine, wasted water and wasted feed, can be collected as liquid slurry under perforated floors or as a solid that includes bedding material from solid floors. Confinement systems concentrate these by-products in one location and generally provide more control in collecting and managing these waste products, but require a greater management effort. Producers of the nonruminant species of livestock (swine and poultry) rapidly adopted intensive, indoor confinement systems. The vast majority of current production of these two species is now in confinement facilities. Producers of the ruminant species (dairy cattle, beef cattle and sheep) have been slower to adopt the confinement model of production, presumably because these animals require forages, like grass or hay, in their diets. The rapid and efficient growth of swine and poultry does not require them to graze forages and they have no need for a large land base for forage production.

Increased size, scale and specialization

Since their inception, the size and scale of indoor confinement systems has increased. Greater size allows these production units to spread their large fixed facilities costs over more production units. Large-scale production units compensate for slim margins with increased output to generate more income

The phases of production in animal agriculture are becoming separated into specialized operations. For example, hog production is moving away from farrow-to-finish to wean-to-finish. This means that the gestation and farrowing takes place on sow operations, and the finishing takes place separately. The same kind of separation and specialization occurred in the poultry industry in the 1970s and 1980s. Now, in the poultry industry, all phases of production (breeding and laying, hatching and finishing) occur on separate sites.

Increased use of growth-promotant technologies

The use of technologies to promote livestock growth and improve productivity has become widespread. Sub-therapeutic doses of antibiotics are used to increase the quantity of daily weight gain and the efficiency of feed metabolism, and decrease morbidity and mortality. It is estimated that 60 to 80 percent of all cattle, sheep, swine and poultry in the U.S. receive antimicrobial drugs at some point during production. Metabolic modifiers, such as steroid implants in beef cattle to improve efficiency of growth and carcass composition. Bovine somatotropin (bST) is used in dairy cows to increase milk yield. It is estimated that 90 percent of beef cattle receive a steroid implant at some point in life. The use of bST is thought not to be as widespread.

Development of new technologies

Other new technologies have been developed and adopted in animal agriculture. These include artificial insemination (used widely in swine and dairy), manure storage pits and basins, and information management systems. Genetic improvements of livestock continuously enhance production, which has increased dramatically. For example, milk produced per cow increased threefold between 1945 and 1998. Swine, poultry and egg productivity has shown similar gains in recent times.

Alternative livestock production methods

Many in the farming community are concerned that there are negative externalities associated with large-scale industrialized agriculture. These people feel that the negative social and environmental impacts of confinement livestock production outweigh the economic efficiencies. There is a movement to try to raise livestock in more sustainable, environmentally-friendly methods. These techniques are often referred to as "alternative".
Alternative production methods for hogs and dairy are described below.

Hogs

Deep-bedded systems are an alternative production method developed for hogs. Large amounts of bedding (usually straw or cornstalks) are used in a total confinement setting where hogs are housed in a group. The bedding absorbs the urine and manure, creating a solid manure pack that reduces the potential for both nutrient loss and odor. New bedding is added frequently so that capacity to absorb manure and urine is renewed. The manure pack decomposes, producing some heat, which is beneficial in winter but must be removed in summer.

In Minnesota, deep-bedding has mainly been implemented in hoop houses for finishing hogs. Hoop houses are arched or curved pipes covered with an opaque, polyvinyl tarp. The ends are left open most of the year, providing natural ventilation, but are closed during extreme weather. Most hoop structures in the Midwest are 30 feet by 72 feet and house about 180 pigs. Some farmers have multiple structures to increase the scale of their operation. Elsewhere, deep-bedded technology is being used in large confinement buildings with several pens. The deep-bedding is used within each pen but not in the alleys between the pens. This approach may be more adaptable for large-scale operations.

Dairy

Management intensive grazing, or rotational grazing, is an alternative production method used by dairy operations. In this system, the pasture area is divided into several small fields, and the grazing cows are rotated as a herd through all of the fields. Cows are restricted to a paddock by movable electric high-tensile fences. Each time the cows are brought back to the pasture after milking. The fencing moves them to a different field. A portable water tank is moved with the cows. Each field is grazed evenly and completely and then can regrow before being grazed again. The cows are constantly grazing in rich pasture, maximizing nutritional value and minimizing overgrazing.

In this system the cows are kept outside other than during milking; they may even stay outdoors in winter and be hand fed. The facilities needed are minimal and a milking parlor is the only necessary building. Manure management is also minimal, since most of the manure and urine is distributed in the pasture. Cropping equipment needs are minimal, since the cows are harvesting most of their feed themselves. Because of intensive management, less pastureland is needed than for more extensive grazing systems. In Minnesota the system has been used by both small (about 50 cows) and larger (200-300 cows) herds.

Developments in animal agriculture marketing

Increased use of contracts. Minnesota has seen increased use of marketing and production contracts, particularly with hogs. Both types of contracts involve setting prices or compensation for livestock produced at some point in the future. In one analysis, between 1996 and 1999, the number of hogs sold from production contract enterprises rose from 13 percent to 31 percent of total sales for the facilities studied. Production contracting is the norm in the poultry industry.

Increased concentration of buyers. Nationally, the percentage of slaughter done by the top four commercial livestock slaughter firms has been rising since the mid-1980s. In 1994 was at 82 percent for steers and heifers, 73 percent for sheep, and 46 percent for hogs. In Minnesota, the number of butter and cheese plants fell from 845 in 1945 to just 20 in 1998.

Increased price volatility. Price volatility, especially for hogs and milk, has increased since the early 1980s. In dairy this is mainly due to changes in federal policy.

Increased globalization of markets. The markets for livestock products have become increasingly globalized as trade barriers have been lowered and new or revised trade agreements such as NAFTA and GATT have been adopted. International trade (as reflected by exports and imports of all products) more than doubled between 1990 and 2000. International markets are important to Minnesota livestock producers. In the late 1990s, exports amounted to around 17 percent of Minnesota farm cash receipts for meat animals and livestock products, 5 to 6 percent for dairy products, and 10 percent for poultry and eggs. However, increased globalization means that Minnesota livestock producers face increased competition from producers in other countries.

Animal agriculture developments by species

Hogs The swine industry in Minnesota faced increasing consolidation from 1982 to 1997, with decreasing numbers of farms and increasing numbers of hogs and hogs per farm. Between 1982 and 1997, the number of farms with hogs declined by 64 percent (from 20,813 to 7,512). In relation to all farms, the percentage of hog farms decreased by 54 percent between 1982 and 1997 (from 22 percent to 10 percent of all farms). The number and percentage of farms with hogs decreased in every county, with the highest decreases in the northern two-thirds of Minnesota.

From 1982 to 1997, the number of hogs in Minnesota increased by 28 percent (from 4,473,181 to 5,722,460). Over the same period, hogs per hog farm increased by 254 percent (from 215 to 762). However, the geographic distribution of hog operations changed during this time. The number of hogs per thousand acres fell in the northern half of Minnesota between 1982 and 1997, as well as in several of the far southeast counties. Increases were concentrated in the southwest and south central counties. Pipestone County had the highest increase in hog numbers per thousand acres, at 162 percent, followed by Martin (150 percent) and Blue Earth (124.4 percent).

Minnesota's national market share of hogs and pigs in inventory increased from 8.0 percent in 1984 to 9.0 percent in 1997. In 1999 Minnesota ranked third nationally in number of hogs marketed. Hog prices dropped from an average of $41.90 per 100 pounds in 1995 to $30.50 per 100 pounds in 1999. Prices have become more volatile based on a comparison of year-to-year hog production and price changes over the past three decades. In the 1970s and 1980s, a 1 percent change in production resulted in a price change of around 1.5 or 2 percent. During the late 1990s, the price response has been at least twice that great. It is unclear how much of the increased volatility is due to the increased prevalence of marketing contracts, and how much is due to other factors.

The use of marketing and production contracts is becoming increasingly common in the hog industry. An analysis of the swine enterprises participating in the Minnesota State College and University Farm Business Management Program and the Southwestern and Southeastern Minnesota Farm Business Management Associations (MinnesotaSCU-FBMA) from 1996 to 1999 shows that more hogs were transferred from the contractee enterprises in 1999 than were sold from the farrow-to-finish enterprises, and nearly as many as from the feeder pig finishing enterprises.

According to a survey of nine of the 12 largest U.S. pork packers, 64 percent of slaughter hog purchases during January 1999 were priced under some contractual method other than the spot market, an increase from 57 percent in 1997. A more recent report found that spot market sales of hogs were down to 17 percent in January 2001, which was an 8 percent decline from 2000.

In response to increasing consolidation in the swine industry, a number of Minnesota pork producers became involved in swine production networks in the mid-1990s. Reasons for joining networks included accessing technology and systems necessary to achieve low-cost production, product quality, competitive volumes or labor simplification. Types of production contract arrangements range from small scale, informal farmer-to-farmer formula pricing arrangements to large scale, jointly owned sow units directed by hired management consultants.

Hog production is moving rapidly away from farrow-to-finish toward systems where pigs are farrowed in a separate enterprise, in large centralized sow production units often located outside of Minnesota. One analysis shows that in 1996, half of the hogs sold came from farrow-to-finish enterprises; only 25 percent were sold from that type of enterprise in 1999. The number sold from wean-to-finish enterprises tripled, from 4 percent to 12 percent, over the four years, while the number in production contract enterprises rose from 13 percent to 31 percent. Independent finishing of feeder pigs has held steady at about one-third of the total marketings, but these finishing enterprises have declined in number and increased in size. In-shipments of pigs to Minnesota were 23 percent of marketings in 1999, almost triple the 9 percent share of marketings in 1995.

Dairy The dairy industry declined dramatically in Minnesota from 1982 to 1997, in both number of dairy farms and number of dairy cows. At the same time there was consolidation in average number of dairy cows per farm, although not the extent experienced by the hog industry. The number of dairy farms went from 24,178 in 1982 to 9,604 in 1997, a decline of 60 percent. The percentage of all farms with dairy cows declined 49 percent statewide from 1982 to 1997, from 26 percent to 13 percent. All counties saw a decline in the number of dairy farms and percentage of dairy farms per total farms from 1982 to 1997. The highest declines were across the north, and in the southwest and south central areas.

The number of dairy cows (including milking cows, dry cows and replacement heifers) decreased by 35 percent between 1982 and 1997, from 1,741,552 to 1,123,924. At the same time, the average number of dairy cows per dairy farm increased by 62 percent (from 72 to 117). It should be noted that since this number includes all dairy cows (milking cows, dry cows and replacement heifers), it should not be confused with dairy herd size. Average dairy herd size (milking cows only) increased from 35 to 56 cows during this time. All counties lost dairy cows between 1982 and 1997.

The changes in the structure of the dairy industry were fairly steady from 1982 to 1997. The decrease in the number of farms with dairy cows was slightly greater in the periods from 1982 to 1987 and 1992 to 1997, when it was about 28 percent, than from 1987 to 1992, when it was 23 percent. Minnesota's decrease in the number of dairy cows was slightly greater from 1982 to 1987 (15 percent) than for either of the other five-year periods (1987 to 1992 14 percent, 1992 to 1997 11 percent). The increase in the average number of dairy cows per farm was greatest from 1992 to 1997 at 24 percent, compared to 1982 to 1987 (17 percent) and 1987 to 1992 (12 percent).

Minnesota's share of the national milk market declined from 8.3 percent in 1960 to 5.9 percent in 1998. Minnesota dropped in ranking from third in 1960 to fifth in 1998. The total milk produced in Minnesota peaked at 10.8 billion pounds in 1985 and dropped to 9.2 billion pounds in 1998. The number of butter and cheese processing plants in Minnesota has declined dramatically, from 44 plants in 1985 to just 20 in 1998, a decrease of 55 percent and a decrease of 77 percent from the 86 plants in 1975.

Prices for milk have been volatile since the mid-1980s. This occurred with changes in the early 1980s in federal dairy policy. As the federal support price for milk moved well below the average production cost, the market price became highly volatile. Because milk is a perishable product it is highly sensitive to short-range changes in the supply-demand balance.

Most milk is marketed through farmer cooperatives with informal marketing arrangements that can change at relatively short notice. Information on the extent to which milk contracts are used is not available. In the U.S., the 10 milk cooperatives with the largest volume accounted for half of 1998 milk production.

Productivity per cow has been increasing steadily. It increased by 66 percent between 1975 and 1998, from 10,119 to 16,833 pounds of milk per cow per year. The largest jump in productivity since 1975 was from 1985 to 1993, when productivity increased by 27 percent. Minnesota's average productivity per cow in 1998 was slightly less than the national average of 17,192 pounds. Minnesota ranks 16th nationally in production per cow.

Some major trends in production have included the introduction in 1994 of bovine somatotropin (bST), a metabolic modifier, to boost milk yield per cow and increased use of artificial insemination, which is now used almost exclusively. There has been a substantial decline in the fertility of dairy cows, such that they often must be bred more than once.

Beef The beef industry in Minnesota declined between 1982 and 1997, both in number of beef farms and number of beef cattle. However, the change was not as dramatic as that taking place in both the hog and dairy industries. There was almost no consolidation over that period, and small operations continue to dominate.

The number of farms in Minnesota with beef cattle fell from 27,411 in 1982 to 21,310 in 1997, a decrease of 22 percent. This was true across most counties, but unlike hog and dairy farms, six counties showed slight increases in the number of farms with beef cattle (Crow Wing, Kanabec, Morrison, Pine, Stearns and Winona). The percentage of all farms with beef cattle remained the same, at 29 percent in both 1982 and in 1997. From 1982 to 1997, 33 or 38 percent of Minnesota counties had an increase in the percentage of farms with beef cattle.

The number of beef cattle decreased by 22 percent between 1982 and 1997, from 1,636,404 to 1,271,532. However, the number of beef cattle per beef farm stayed approximately the same at 60 head per beef farm during that period. Beef cattle declines were highest in Faribault (-63 percent), Grant (-60 percent), Lac qui Parle (-57 percent), Jackson (-57 percent), and Freeborn (-53 percent) counties.

Changes in the beef industry were greatest from 1982 to 1987, while the five years from 1992 to 1997 saw almost no change. From 1982 to 1987, the number of farms with beef cattle decreased by 17 percent, compared to 7 percent from 1987 to 1992 and a 1 percent increase from 1992 to 1997. Similarly, the change in the number of beef cattle was most significant from 1982 to 1987, when it fell by 25 percent. This was followed by much smaller changes from 1987 to 1992 (4 percent increase) and from 1992 to 1997 (1 percent decrease). While the average number of beef cattle per farm stayed the same over the entire 15-year period, there was some volatility during that time, with a 10 percent decrease from 1982 to 1987, a 12 percent increase from 1987 to 1992, and a 2 percent decrease from 1992 to 1997.

Minnesota's national market share of beef cows has remained at the same level, 1.2 percent in both 1985 and 1998. Minnesota does not rank in the top 10 states for its national market share in beef cows. With cattle on feed, Minnesota has lost some market share, falling from 3.2 percent in 1981 to 2.0 percent in 1998. Minnesota ranks 10th in its market share of cattle on feed.

Concentration of U.S. commercial beef slaughter has been increasing. The percentage of slaughter done by the top four firms has been rising since the mid-1980s, and was at 82 percent for steers and heifers in 1994.

Unlike the hog and dairy industries, artificial insemination and embryo transfer technologies are seldom used in the beef industry. The most common uses of these technologies are the seed stock or purebred operators, who use them to enhance genetic progress.

Poultry Over the last 15 years the poultry industry in Minnesota has seen tremendous consolidation in all three areas – layers and pullets, broilers and turkeys. The number of animals in inventory has remained stable from 1982 to 1997, while the number of farms with poultry decreased. However, while the long-term trend is dramatic consolidation, the trend slowed considerably over the most recent five years of data (1992 to 1997).

Each area of the poultry industry experienced slightly different trends. The layer industry showed significant consolidation from 1982 to 1997, especially in decreasing farm numbers and increasing numbers of layers and pullets per farm. The number of farms with layers and pullets decreased by 70 percent between 1982 and 1997, from 6,468 to 1,964. The percentage of layer/pullet farms decreased by 61 percent (from 7 percent of all farms to 3 percent). The number of layers and pullets stayed roughly the same, changing by only 1 percent (from 12,928,376 to 13,047,875). Layers and pullets per farm increased by 232 percent (from 1,999 to 6,644).

Decreases in the number of farms with layers and pullets were greatest from 1982 to 1987 and from 1987 to 1992 (-38 percent and -42 percent, respectively). From 1992 to 1997 this slowed considerably, with a decrease of 15 percent. The number of layers and pullets, while staying roughly the same over the entire 15-year period, bounced back and forth during that time with decreases from 1982 to 1987 and 1992 to 1997 (-6 percent and -9 percent) and an increase of 18 percent from 1987 to 1992. The number of layers and pullets per farm increased most dramatically from 1987 to 1992, at 105 percent. This slowed greatly during the 1992 to 1997 period, when the number increased by just 7 percent.

In 1964, the inventory of layers and pullets was reported to be approximately 14.6 million; in 1997, the inventory was approximately 13 million birds. Over the same time period, however, the number of farms reporting inventory dropped precipitously from almost 48,000 farms to just fewer than 2,000. The average number of layers and pullets per farm increased dramatically from 306 in 1964 to 1,999 in 1982 to 6,644 in 1997.

The broiler industry showed significant consolidation from 1982 to 1997, in terms of decreasing farm numbers, increasing broiler numbers, and increasing numbers of broilers per farm. During that time, the number of farms with broilers decreased by 56 percent (from 1,411 to 621) and the percentage of broiler farms decreased from 1.5 percent to 1 percent of all farms. During the same period, the number of broilers in Minnesota increased by 26 percent (from 22,556,750 to 28,456,532). Broilers per farm increased by 187 percent (from 15,986 to 45,824).

Minnesota's national market share of broilers raised annually has stayed relatively constant, at 0.7 percent in both 1984 and 1996. Minnesota's market share does not rank in the top 10 states nationally. Production contracting is the norm in the poultry industry, with 85 percent of broilers grown under contract in 1995. Most of the remaining chickens are grown on farms owned and operated by the integrator.

The turkey industry in Minnesota also had dramatic consolidation between 1982 and 1997 in terms of decreasing farm numbers, increasing turkey numbers, and increasing numbers of turkeys per farm. The number of farms with turkeys in Minnesota in 1982 was 804; this number declined by 31 percent to 553 in 1997. The percentage of turkey farms decreased by 12 percent (from 0.9 percent to 0.8 percent). At the same time, the production of turkeys increased, with the total number of turkeys increasing by 209 percent (from 5,255,232 to 16,220,257). The intensity of turkey farming increased even faster; the number of turkeys per farm increased by 349 percent (from 6,536 to 29,331) from 1982 to 1997.

Consolidation in the turkey industry slowed from 1992 to 1997. The number of farms with turkeys decreased most dramatically from 1987 to 1992 (by 25 percent) and from 1982 to 1987 (by 10 percent), but this slowed considerably during the 1992 to 1997 period, when the number of turkey farms decreased by just 3 percent. The total number of turkeys in Minnesota increased throughout the 15-year period, with the greatest increase occurring from 1982 to 1987, at 68 percent. The average number of turkeys per farm also increased throughout the 15 years, but at a decreasing rate, going from an 87 percent increase in 1982 to 1987, to 64 percent in 1987 to 1992, to 46 percent in 1992 to 1997. Minnesota's national market share of turkeys raised annually has fallen slightly from 13.7 percent in 1980 to 13.2 percent in 1996. However, in 1999 Minnesota ranked second in the nation for its market share of turkeys raised.

The description ends with a series of photographs of real Minnesota livestock production systems. Pictures of Minnesota Production Systems for Beef, Dairy, Swine and Poultry. All Pictures used with the permission of Don Breneman, University of Minnesota, Extension Service.

Beef grazing harvested fields in Northwest Minnesota

Beef in open lot in Southwestern Minnesota

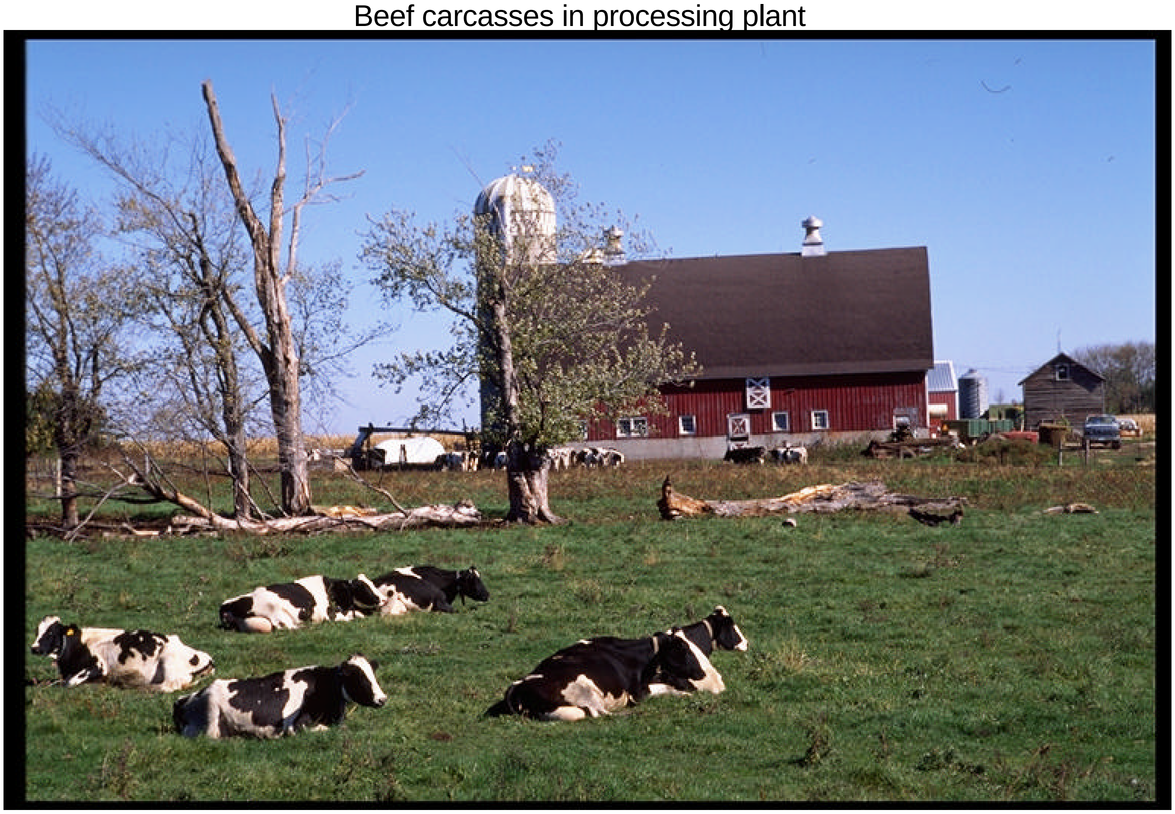
Beef Cow grazing near Alexandria

Dairy Cows in open lot Stearns County

Beef in Dirt lot pen in Minnesota

Dairy Cows on newspaper bedding in free stall barn

Beef carcasses in processing plant



Dairy cows grazing on old farmstead

Rotational grazing dairy

t

Dairy cows on muddy open lot

Dairy cows inside a free-stall
barn

Modern milking facility

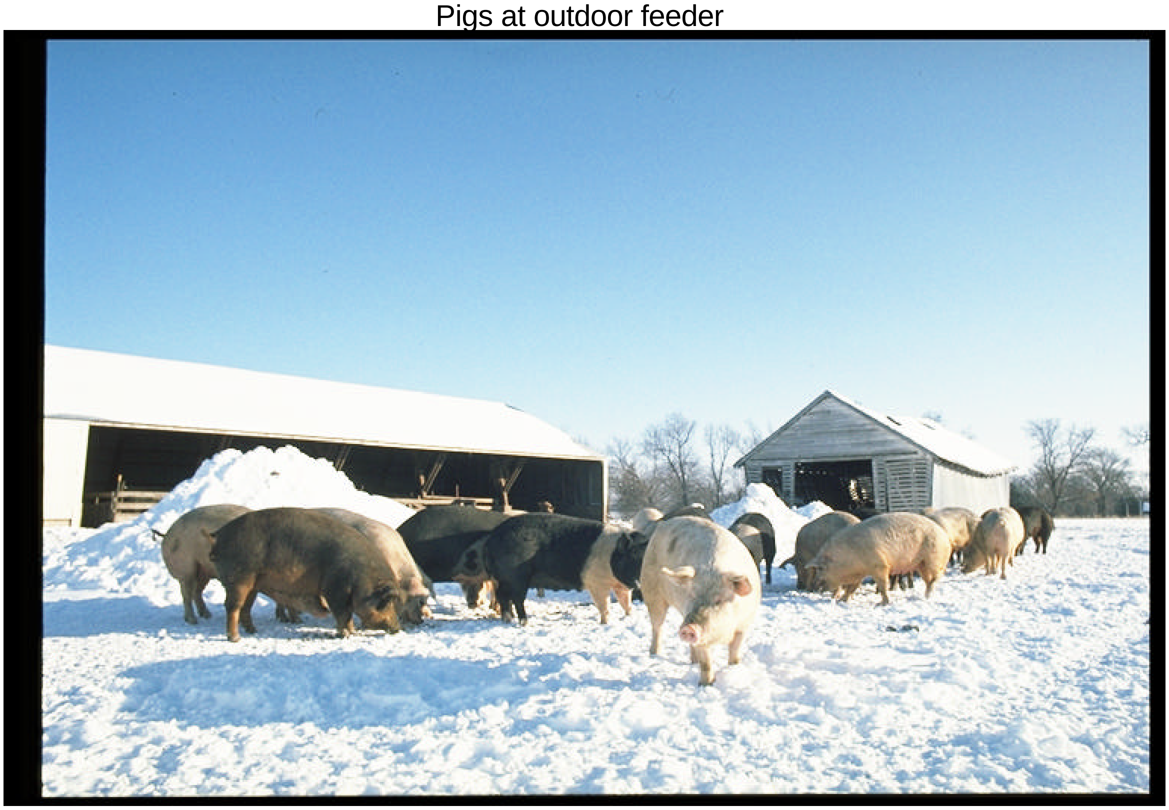
Spraying dairy cows inside free-stall barn

Inside a turkey barn

Wild turkey in the barnyard

Egg-laying operation inside the building

Pigs at outdoor feeder



Pigs playing in the snow

Pigs wallowing in the mud

Mother nursing piglet's old way

Pigs in confinement pen

Mother nursing piglets in sow crate

Deep bedded pig barn (Swedish system)

Hog carcasses at processing plant

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Social/Community Issues

Animal agriculture has historically been critical to Minnesota's economy and has contributed to the culture of many of the state's rural communities. However, changes are having a significant effect on those involved in agriculture and on rural communities. The purpose of this topic of the GEIS is to identify the impacts of changes in animal agriculture on social and community well-being in rural Minnesota. The topic covers the relationships between animal agriculture and the way in which people live, work, relate to one another, organize to meet their needs, and generally cope as members of society.

The scoping document contains the following specific questions regarding social and community impacts of animal agriculture:

1. What is the relation between different types of animal agriculture production systems and the following social elements:

   a. Demographics (racial and ethnic distribution, residential stability, residency),

   b. Community and institutional factors (size and structure of local government, linkages between levels of government, voluntary and other local associations, employment and income characteristics, and opportunities for new wealth),

   c. Political and social resources (distribution of power and authority, leadership, channels of complaint response and redress, changes in the way stakeholder groups are identified, and ownership patterns),

   d. Individual and family changes (perceptions of personal risk to health and safety, trust in institutions, friendships and family relations, attitudes about social well-being, job satisfaction, neighborhood identity and neighborliness, community involvement, enjoyment of property, and attitudes toward cultural diversity),

   e. Community resources (housing, public services, natural resources and land use, historical and cultural resources),

   f. Social capital (the ability of people to respond to difficulty, the ability of people to work together to find solutions to problems, and trust between community members),

   g. Quality of life.

2. What is the relation between changes in the ownership, control and legal structure in the animal agriculture industry and how do these changes affect the way that stakeholders are identified, the way the affected public is responded to, or the benefits that accrue to the local community?

3. What is the relation between animal agriculture production systems and consumer and citizen attitudes with respect to:

    a. Quality of animal products and food safety,

    b. Treatment of animals and ethics,

    c. Consumer need to know about food supply and

    d. Consumer demand and willingness to pay for food as well as externalities that may result from production of animal products.

4. What mechanisms are available for producers and their neighbors to resolve perceived problems related to animal agriculture in their communities and how effective are these mechanisms?

Note: scoping study question #3 above has been removed from the Social/Community topic. Information responding to the four subquestions can be found in the following locations:

- A review of identified literature on each subquestion can be found in the 1999 Literature Summary beginning on page A-21 and in the Social/Community TWP on page 54.

- Subquestion ‘a’ is addressed in the chapter on human health and in the corresponding TWP and chapter of the Literature Summary.

- Subquestion ‘b’ is addressed in the animal health and well-being chapter and the corresponding TWP and chapter of the Literature Summary.

- Subquestion ‘c’ refers to individual dietary choices and is not addressed in any part of the document, except indirectly. CAC took no position on dietary issues.

- Subquestion ‘d’ is further addressed as an economic factor influencing animal production in the GEIS economics chapters, Literature Summary and TWP.

In contrast to the plan followed in other chapters of the GEIS, this chapter does not attempt to organize the social/community findings under the outline of the study questions. The information found about social/community impacts is mostly very general, which made it challenging to address the detailed and specific subparts of the study questions. Rather than follow an outline where many of the items would contain no information, the material is presented according to "themes" identified in various case studies. All information found elucidating the study questions has been included.

The information in this chapter was derived from two sources, the 1999 Literature Summary, Chapter A, and the 2001 Social and Community Impacts Technical Work Paper. The Literature Summary chapter provides a great deal of historical and socioeconomic context and background information. The TWP provides an update on the literature summary since 1999 but focuses on case studies conducted especially for the GEIS in six counties: Clearwater, Goodhue, Morrison, Pennington, Rock and Stearns.

The case studies were commissioned to assess the impact of changing patterns in animal agriculture on this cross-section of rural communities. Information was gathered by the consultant team through interviews, roundtable discussions and analysis of media accounts. Due to considerable overlap among the topics, consultant team members working on the Land Use Conflicts and the Role of Government TWPs assisted the Social/Community team in the discussions. The case studies provided information that was organized into five themes in the Social/Community TWP: community well-being and social capital; quality of life; changes in population dynamics; changes in the structure of animal agriculture and the future of animal agriculture.

The reader may refer to the Social/Community TWP for more detailed information on the themes identified. Section 2 of the Social/Community TWP explains how the counties were selected and provides background information on each. Section 3 explains how data was gathered for the case studies. Attachment 5 of the TWP contains verbatim narratives of the roundtable discussions (with the identities of participants deleted).

Community Well-Being and Social Capital

Community is defined in a geographic sense, as a group of people who see themselves as residents of a specific locale. Community well-being is defined as the levels and balance of bridging and bonding social capital found within a community. Social capital is the trust, mutual reciprocity and sense of shared future between individuals, and the ability to work constructively for the good of the community. It forms the fabric of family life and community dynamics. Indicators of bonding social capital include the quality of relationships between community and family members, and individual and collective responsibility to solving community related problems. Indicators of bridging social capital include community links to outside groups and knowledge. Opportunity for community dialogue, such as the chance to express one’s opinion about a community concern with the sense that it will be respected, is also key to the presence of strong social capital.

Social capital exists alongside other forms of capital in the community that can be combined and invested to create new resources, such as human capital (the skills, knowledge, health and leadership abilities of local people), environmental capital (ecosystem health and community attachments to the local environment), and economic capital. Social capital is more abstract than human, environmental or economic capital and is not as readily visible.

Nonetheless, the presence of social capital is crucial in that it can lower transaction costs of new development, contribute to other forms of capital and enhance the flexibility of a community.

Several case studies discussed in the GEIS 1999 Literature Summary identified qualitative effects of conflict and controversy on communities. For those on all sides of complaint and controversy regarding changes in animal agriculture, there appears to be a common "frame" – that of rights and entitlements. In their research on the hog industry in North Carolina, McMillan and Schulman (2001) found that all parties involved use this master frame in understanding their position. Middle-class white activists have a civic rights frame - they believe the government should protect their rights.

For African-American Muslim anti-hog activists, this is an environmental justice and civil rights frame - they want the same rights as whites. Producers frame their position in terms of property rights and a right to earn a living from their land. Citizens who are neither producers nor activists frame their position in terms of the right to enjoy their own property. Community leaders are concerned with the right to make a living in terms of both agriculture and industry, as long as this does not violate someone else's right to make a living. These different frames, or collective identities, are drawn upon to define one's position relative to the controversy.

In an examination of changes in the way stakeholder groups are identified in the swine controversy in North Carolina. Ladd and Edwards (2001) point to a convergence over time of local citizen groups with state and national sustainable agriculture and environmental justice movements in their opposition to confinement hog production facilities. Parallels have been identified between social and environmental justice concerns, the situation of small farmers, food security, sustainable agriculture and rural community empowerment. They suggest the controversy has the ability to integrate these diverse stakeholders into a single movement. North Carolina environmental justice organizations have used local and state conflicts regarding hog production facilities to mobilize minority, poor and marginalized rural communities. At the same time, they point to development of new constituencies on both sides of the swine controversy in North Carolina, as well as an expanding division between these two sets of stakeholders.

An ongoing study in Nebraska, however, seems to be finding that the values of the diverse groups are not necessarily the same although they may be united in opposition to projects. This study (Blankenau and Snowden, 2000) is examining how community activism develops against industrialized agriculture in rural areas. They examine a case where local farmers successfully blocked a corporate owned large-scale livestock facility. They were interested in knowing if these local activists made the connections between what was perceived as the immediate threat, and the larger social, political and economic forces behind changes taking place at the local level. What they found was an understanding of these processes in terms of local impacts, but little recognition of how they operate at the national and international level. Additionally, the ideologies of groups from outside the local area who also opposed the development did not resonate with rural residents, with one exception. Both the positions of oppositional groups and historically held rural values are in conflict with the value of 'bigger is better'.

Research findings from the case studies.

GEIS case study data from the six selected Minnesota counties reflected a decreasing level of individual and community trust in core government institutions at the state, and in some situations, the local level. These institutions - the MPCA, local planning and zoning and elected officials - are seen as responsible for perpetuating a hostile and inequitable community climate. Case study participants who had taken advantage of the opportunities for public involvement in feedlot matters did not typically look back on the experience with a sense of satisfaction that they were able to participate in the regulatory process. Rather, they resented the fact that they had to do it at all, and that the government had not taken a more active role in ensuring that they and their environment were protected.

Policies developed by governmental bodies are viewed by both producers and other stakeholders as exacerbating problems at the local level rather than resolving them. Many complaints concern access, particularly in the case of getting information or action from the MPCA. The lack of responsiveness and responsibility of this key agency, with authority to mediate conflicts, delegitimizes the state as an effective feedlot regulatory authority. When processing feedlot permits and reviews is drawn out over months and even years, stakeholders in the community are left with a sense of uncertainty about their future and frustration that can result in attempts to resolve conflict through extra-legal means. The absence of trust in these key institutions raises significant issues for the future role of public agencies in fostering or abating social tensions and community fragmentation in agricultural areas.

These results are similar to findings of a 1996 Minnesota Extension Service study in which farmers and nonfarming citizens expressed dissatisfaction with state agencies and local planning and land use regulations. Both groups suggested that state agencies need to work 'with' people, and local elected and appointed officials need to base their land use decisions on 'facts and findings.' While there were otherwise clear differences in the perspectives of these two groups concerning animal agriculture, there was clear consensus in their criticism of state and local government entities.

In addition, a regulatory system that depends so heavily on complaints and citizen opposition “pits neighbor against neighbor.” When members of the public raise objections about pollution from an industrial facility, they are often complaining about the behavior of a faceless corporation. In the feedlot context, in contrast, they are often objecting to the actions (or proposed actions) of their neighbors, and the conflict frequently becomes more personal and painful. Complaining to the government about their neighbors is hard, particularly in public and in a setting that may be intimidatingly formal. Public hearings regarding a proposed facility, whether run by the MPCA or a county, often involve standing before an audience and speaking into a microphone; hearings may even be broadcast on cable television. These formalities are for the most part designed to broaden public awareness and access to the regulatory process, but they may actually stifle involvement by intimidating some who would otherwise raise objections. Some may also be intimidated because they fear retaliation within their community if they speak up in opposition to a project, or raise complaints about an existing operation. Others, who had been active in such proceedings also spoke of how exhausting it was to try to stay involved long enough to have an impact.

Farmers have serious complaints about this system too, and many believed they had been the subjects of unfair complaints. Some felt they were the subjects of simple harassment from their neighbors. Others felt that those raising objections were basing them on unfounded fears or inaccurate information. This latter concern is probably well founded in some circumstances. In cases where nonfarm populations are moving into farming areas, the new residents are indeed unfamiliar with the basics of animal agriculture, and may not have the ability to judge whether a particular practice truly threatens their health or the environment. In other cases, as large feedlots are being constructed in areas where smaller farms have predominated, traditional farmers may be unable to judge the extent of environmental risk posed by the more concentrated form of raising animals. Some operators of large new feedlots believe the environmental objections raised by their neighbors actually reflect resentment based on economic or social factors, and it would be surprising if this were not sometimes the case. Even when it is not the case, feedlot operators will often be left wondering about the motives of those who complain. In addition, just as it is hard for citizens to object publicly to their neighbor’s feedlot, it is difficult for farmers to have their feedlots publicly criticized by their neighbors.

Situations with the greatest perceived disparities between large and small producers, or between producers and other stakeholders (neighbors and others) had the least unity in shared vision for the future. Small and middle-sized producers shared notions of "get big or get out" and a fatalistic or inevitable view of the future, while large producers and those who are vertically integrated, operating under production contracts, or who own one or more confinement buildings have a different vision of the future. They look toward a continued role in further industrialization of animal agriculture as part of a production and profitability paradigm. There is also a potentially larger cleavage in the shared vision of local communities. In some locations there did not appear to be a role for a changing animal agriculture within the broader community vision for the future. This was particularly so in cases dominated by urban areas.

Opportunities for community dialogue regarding local issues are another indicator of social capital. Formal opportunities for community dialogue in respect to local issues surrounding change in animal agriculture were not identified in the research.

Paradoxically, participants in roundtable discussions convened for the purpose of this research, said this was the first opportunity for dialogue in their community. Analysis of local newspapers done as part of the case studies (see the Social/Community TWP for details of how this analysis was done) suggests local residents are increasingly using letters to the editor as a means of public dialogue; this dialogue has become personalized in some places. This is not surprising, as personal contacts suggest opportunities for expressing individual opinions in community meetings are confined to hearings on specific projects where time is limited or the number of comments restricted.

Informal community dialogue has broken down in some communities, and there are differing levels of community conflict in different contexts of this examination. The situations with the highest level of conflict are those influenced by growing urban areas and the highest nonfarming populations. This has impacted the bonding social capital in local communities to varying degrees. Community responses to the siting or expansion of an animal agriculture facility are quite diverse. In some cases groups are organizing to combat what they perceive to be a threat to their way of life through the possibility of environmental hazards and social maladies. Such a response to animal agriculture may not always succeed in achieving the desired future outcomes, but it can have the impact of reinvigorating community capacity to act strategically. Many people, especially women, told us that because of the community conflict over animal agriculture, they took a leadership role in opposing the facility. Other individuals have not developed such potential for action. Some individuals have adopted a fatalist perspective, viewing themselves as condemned to live with what they term the "stench" and the "undemocratic control by those with local power."

Quality of Life

The case study research points to quality of life impacts for Minnesota residents that seem to cross all boundaries of place and group. For producers, changes in animal agriculture are viewed with mixed emotions. Among those who have expanded their operations, including those who have constructed confinement operations and entered into contract production, most consider industrialization of animal agriculture to be a positive influence on farming operations and personal and family quality of life. It allows them to continue farming in the face of narrowing profit margins, or allows another family member to join the operation.

Producers in their mid-50s and older who have not made changes in their operations expressed concern with the amount of debt taken on by young farm families to expand and build new confinement buildings for poultry, swine and dairy. Although these older producers did not see their own quality of life impacted by changes in animal agriculture, they did express a sense of loss for a way of life. based in diversified family farms tied to a local food system. For younger small and mid-sized producers not engaged in contract production, industry expansion has impacted them by tightening their access to markets with equitable prices. This has quality-of-life impacts as they are often balancing an off-farm job with animal husbandry responsibilities. This decreases the amount of time they spend with their families or in leisure activities, and means a tighter household budget from which to meet their family's day-to-day needs.

Participants whose home property neighbors a large-scale animal production facility (almost always a confinement operation) reported the greatest reduction in quality of life. Odors, noise, increased truck traffic, health problems and concerns about well-water safety curtail their ability to enjoy their home and conduct day-to-day activities. While the problems may not be constant, there are specific times or days when odors, noise or other intrusions from the production facility interfere with daily activities, decreasing quality of life.

Community members not involved in animal agriculture, or not directly affected because of the location of their property, do not feel that animal agriculture or changes in animal agriculture affect quality of life. They may hear about it in stores and coffee shops, read about it in the newspaper, or even smell odor from a facility as they drive through the neighborhood. However, since it does not have a direct bearing on their lifestyle it does not become something they are concerned about. The media analysis points to a declining visibility in animal agriculture over the past decade, further dividing these 'bystanders' from those who consider themselves stakeholders in animal agriculture.

Quality of life impacts, as they related to various aspects of producer satisfaction, were also considered by Palmer and Bewley (1999) in their examination of Wisconsin dairy operator expansions. They found that between 1994 and 1998, the average herd size of those who expanded their operations had doubled. And while most (72 percent) expanded by adding on to existing facilities, those who were most satisfied with their expansion built all new facilities. However, producers who did not change their type of dairy facility had significantly better relations with neighbors than those with all new facilities. In other words, building all new facilities provided the greatest producer perceived benefit, while adding on to existing facilities resulted in greater neighbor benefits. In addition, producers with larger herd sizes were more satisfied with all aspects of their operations - personal satisfaction, personal health, household income, family relationships, time away from the farm, and overall quality of life, with one exception. Those with smaller herds were more satisfied with their neighborhood relationships.

Changes in Rural Population Dynamics

Nuisance complaints Local elected officials interviewed for the case studies noted how changes in population dynamics have resulted in local tension and sometimes conflict. 'New-to-rural' neighbors contact their elected officials with complaints about mud on roads from tractor tires, odors from livestock and poultry operations, noise of farm equipment operating around the clock in the spring and fall, siting of new livestock and poultry barns, and the need for township roads to be plowed by early morning after a snowfall so they can commute to work. The officials the social/community team spoke with indicated these concerns are very different from the ones received when it was primarily farm operators who resided in rural unincorporated areas. These comments came from most of the case counties but were of particular note in Goodhue County, which has become home to many new-to-rural households commuting both to the Twin Cities and Rochester.

On a more positive note, producers spoke of the impact the change in local population has had on farming operations. Most noted an increased attentiveness to manure management activities in light of nonfarming neighbors.

Decreased opportunity for community involvement

One of the ways in-migration from urban areas and the decrease in proportion of farmers influences rural institutions is a shift in scheduling of community functions such as church, school or civic group events. Farm families told how community program schedules no longer coincide with farm schedules as they did when there were more people involved in animal agriculture. For example, when there were more dairy farmers such events started later in the evening – at 7:30 or 8:00 p.m. – to take into account the evening milking schedule. Now that there are more nonanimal agriculture residents in the community such meetings and events start earlier, in effect negating the participation of families with small and mid-sized dairies. For some this has meant decreased involvement in core social institutions such as the church.

Other population changes mentioned in the roundtables and interviews were the aging of the farm population, declining membership in rural churches, and changes in the type of labor being used in farming and processing operations.

Impact on youth organizations

Historically important youth organizations have also been impacted by changes in animal agriculture. Membership in both 4-H and FFA has declined and/or changed in most areas. The number of animals exhibited at many county fairs has declined. The focus of both of these organizations has shifted away from animal production to other project areas, including a new emphasis on community leadership. In a growing number of 4-H Clubs and FFA chapters, the children of farmers are now a minority of the membership.

The declining number of farm families has also affected agriculture programs in rural school systems. In some cases these programs are no longer offered in the school curriculum due to lack of interest or lack of support for funding. Where these programs are still available the interest in production agriculture has declined. Students are more interested in forestry, food processing and agricultural marketing. Like their parents, farm youth perceive a change in the future of animal agriculture.

Changes in the structure of animal agriculture and future farming

The most dominant theme in the personal interviews and cases studies was a change in the structure of agriculture, and animal production specifically. This came through in all of the case counties and roundtable discussions.

Perceived limited options for producers

One of the most troubling findings of this study was the prevalence of an economic determinism or fatalism expressed by respondents. Most producers and agriculture-related professionals the social/community team spoke with see few options other than to "get big or get out." This refrain was heard repeatedly to describe how current and former Minnesota farmers view options in terms of animal agriculture. For most of the 20th Century, farmers have faced constraint on the choices they can make regarding both crop and animal production. Confinement systems add pressure to expand either by becoming more capital-intensive or buying more land and more animals. Swine and poultry producers most often expressed this sentiment. Producers overwhelmingly felt existing markets, government subsidies and even government regulations are designed to benefit and encourage large-scale animal production.

The perceived lack of choices for profitable food provision systems affects the future choices and opportunities of all farm operators, regardless of size. Producers often discourage their children from going into farming. This behavior was not specific to any livestock species. Producers and others drew a connection between loss of small animal farms, growth in large animal production facilities, and the community impacts of this change.

Vertical integration and corporate farming

Vertical integration of livestock production, processing distribution and marketing into large corporations was often pointed to as an emerging trend during personal contacts in the case studies. As one producer put it, "many farmers were very upset in that what they were seeing was the beginning of corporation farming and they see that as a threat to their own security." The notion of farmers becoming the employees, even referred to, as "slaves" of corporate-owned agriculture, was a recurrent theme in our interviews with both small and large producers. The ownership arrangements of contract production (specifically in poultry and swine) were viewed by some as a precursor to increasing control and even takeover of farm-site production by national and international corporations.

In the interviews and roundtable discussions the term "corporate farm" was used to refer to vertically integrated and to large, multi-owner farming operations (not necessarily vertically integrated operations). While these animal agriculture facilities are within the scope of Minnesota's anti-corporate farming laws, it is interesting to note that other community members - including other farmers - consider these are corporate farms, not family farms.

Decreased visibility of animal farming

From producers to consumers, nearly everyone the social/community team spoke with agreed that animal agriculture was visually disappearing from the rural Minnesota landscape. Fewer livestock operations are dotted throughout the countryside and those remaining are more concentrated and capital-intensive or industrialized. Rural dwellers who were interviewed would point to nearby farm sites that housed animal production as recently as 10 years ago. While many of the farm sites they pointed to were still standing, the families who occupy them are strictly in crop production (frequently along with in-town jobs) or these have been sold to nonfarming households. These people could also identify new confined animal production facilities that had been erected in their neighborhoods for swine, poultry and dairy production. Most respondents interpreted this restructuring as a loss, viewing the reduction in animal operations and the intensification of animal production by a few producers as having a negative impact on the economic vitality and social fabric of their community.

Neighborhood impacts of large production facilities

When a producer expands an operation or constructs a confined production facility, there are impacts on both farming and nonfarming neighbors. Nonfarmers interviewed tended to focus their concerns on fear of potential hazards to their health or the environment and a reduced quality of life.

Rural residents not engaged in farming also indicated concern regarding destruction to township and county roads by heavy equipment and trucks that travel to and from large animal facilities. Complaints that these vehicles destroy the roads, track roads with animal manure, and drive at speeds beyond safe limits were not uncommon. Fear of reduced property values was common among those who owned real estate in the vicinity of a large confinement operation.

Changes in shared production practices

Both small and large producers cited changes in the shared production practices of farmers. They indicated large operations are very independent and do not need to rely on shared equipment or labor exchanges, with other producers. One person explained that farmers are more "self-contained." They do not interact with many people, nor do they have a need for broader support. Another spoke of a transition from camaraderie to individualism. This manifests in a decrease in opportunities for interaction between farm operators and more broadly in a change in production practices. This appears to reflect a general trend in agriculture rather than one specific to animal production and was a point made in many interviews.

Networks of swine producers have formed to share production practices. Several of these local networks were identified in the case study counties, established primarily as an alternative to contracting with a large corporation. These farmer-to-farmer contracts establish networks of producers from farrow to finish in confinement settings located on their individual farm sites. Producers in the network share equipment, trucks and labor. Those involved perceived this as a desirable situation, and felt supported by the cooperative nature of their group.

Changes in rural culture

Some farmers see the lack of understanding of their occupation to be a further challenge to operating their business. Rising costs of inputs, declining prices for their product and a heightened regulatory climate, combined with challenges from 'new-to-rural' dwellers that are offended by confinement practices, seem to paint a dim future for livestock production.

Conclusion

The most persistent theme in the research is that community impacts of animal agriculture are changing. These impacts can be perceived as either positive or negative. Community conflict seems more related to individual perception of risk and project context than reality or individual quality of life.

Proponents of change in animal agriculture see themselves as responsible citizens who provide jobs and revenue to the local economy. They feel their work is honorable and contributes to their own quality of life but also to the well-being of the community. This view is challenged by those who take issue with confinement production practices and vertical integration of animal agriculture. They sometimes feel powerless to make changes that affect their quality of life or the future of animal agriculture.

It has been suggested that change and growth in animal agriculture production is a metaphor for the changes in the geography of U.S. agriculture. What has been a conceptual difficulty in adequately defining 'rural' has expanded to include our definition of 'agriculture'. There are two main visions of rural reality. From one perspective, there are citizens who view rurality, and the future of what they define as rural areas, as one based in historical concepts of traditional agricultural production. In contrast is the position that a high-technology approach is the foundation of present and future successful agricultural and rural development. While these differences may manifest in local struggles over regulation of animal agriculture, these may also reflect a broader political struggle over the future of rural areas.

Recommendations for further Social Research

CAC policy recommendations relating to Social and Community issues are found in Appendix D of this document. A number of technical recommendations from the North Central Regional Center for Rural Development and University of Minnesota staff can be found in the Social and Community TWP document. Acceptance of the final TWP does not imply endorsement of the consultant’s technical recommendations by the CAC or EQB. Additional social, legal and environmental research is needed on the potential impacts of animal agriculture in Minnesota with regard to the social ramifications of feedlot issues.

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Land Use Conflicts and Regulation

The material in this chapter is based on the GEIS 1999 Literature Summary, Land Use Chapter B and the 2001 Technical Work Paper (TWP) on Land Use Conflicts and Regulation. The TWP provides additional depth on a number of key areas, especially land use conflicts and demographic information. The TWP also contains useful state data and maps. Readers should explore these resources for detailed information.

This chapter is based on land use study questions explored in the Scoping Document. This topic overlaps with the Role of Government and Economics TWPs on common issues. As stated in the Scoping Document, the land use topic addresses potential conflicts caused by the proximity of livestock raising and nonfarm uses of land such as housing development and the recreational use of resources. It also addresses how these conflicts can be mitigated with land use planning and zoning.

Recent trends in agriculture, demographics, and land use

Animal agriculture has changed significantly over the past two decades in Minnesota. Conflict between feedlot operators and neighbors has risen over changes in rural settlement patterns, the density and concentration of animals, and the economic structure of farming. Using existing data from the Office of the State Demographer and the U.S. Department of Agriculture (USDA) Census of Agriculture, the land use team compiled trend data for a number of agricultural production, demographic and land use variables from 1982 to 1997.

Demographically, total population statewide increased 15 percent, there was a 2 percent decrease in rural population and a 33 percent decrease in farm population; however, there was a 3 percent increase in rural nonfarm population. Thirty counties saw an increase in rural population. Rural population includes people residing outside of incorporated places greater than 2,500 population. Counties with the largest gains in actual numbers of rural residents were counties with large gains in rural nonfarm population. Farm population fell everywhere in the state from 1982 to 1997, with the exception of Itasca County. Rural nonfarm population mainly fell in agricultural areas, and increased in the nonagricultural areas. All counties lost farms between 1982 and 1997, with the exception of Itasca and Ramsey counties, which had minute increases. Central Minnesota and the Red River Valley in northwest Minnesota had the largest percentage decreases. All counties saw a decline in dairy farms per total farms from 1982 to 1997. Outside of the seven-county metro area, average farm size increased in all counties except Cook between 1982 and 1997. Some of the counties that gained the most in average farm size were also those that lost the highest percentage of farms between 1982 and 1997.

Dairy and beef farms overlap geographically in a band from central to southeast Minnesota. There is some geographic overlap of counties between beef farms and hog farms in southwest Minnesota. However, there is little geographic overlap between hog farms and dairy farms. Beef farms and beef cattle are more widespread throughout the state than are hog farms and hogs and dairy farms and dairy cattle.

Looking specifically at livestock, statewide there were 0.14 hog farms per 1,000 acres in 1997, a decrease of 63.9 percent from 1982. However, during the same period, hog numbers increased by 27.9 percent, to 106.03 hogs per 1,000 acres in 1997. This shows that the number of hogs per hog farm increased between 1982 and 1997. Statewide there were 0.18 dairy farms and 20.82 dairy cows per 1,000 acres in 1997, decreasing 60.3 percent and 35.5 percent respectively from 1982. This shows that on average the number of cows per dairy farm increased between 1982 and 1997. In 1997, there were 0.39 beef farms and 23.56 beef cattle per 1,000 acres statewide. These numbers were both down by 22.3 percent from 1982.

Over the last 15 years, the poultry industry in Minnesota has seen tremendous consolidation. The number of animals in inventory has remained stable from 1982 to 1997 while the number of farms with poultry has decreased. Four counties (Kandiyohi, Meeker, Stearns and Todd) produced nearly 50 percent of all turkeys sold in Minnesota. Six counties (Stearns, Morrison, Cottonwood, Benton, Douglas and Fillmore) produced nearly 90 percent of all broilers sold in Minnesota in 1997.

Scoping Question 1: What are the current land use conflicts associated with animal agriculture in Minnesota, including conflicts with the use of resources for recreation and tourism and land for housing and urban development?

Land use conflicts related to animal agriculture are a microcosm of the broader social, economic, environmental and legal values influencing all decisions about the use of land. Virtually every land use conflict can be framed in terms of differing value systems, and/or the weight given to a particular value. The fact that land can be simultaneously valued as a commodity, natural resource, habitat, cultural setting and aesthetic amenity complicates the land use decision-making picture. Any land use change can affect one of these values and result in community conflict.

Rural land use conflicts existed long before the introduction of modern animal feeding operations. Land use conflicts in rural areas have often occurred between agriculture and competing economic uses of the land. Traditional, rural natural resource-based land uses such as farming, ranching, forestry, mining and fisheries now compete with other economic activities, especially those devoted to tourism and outdoor recreational land uses. Heightened concern over environmental quality has engendered conflicts related to agricultural impacts on surface and ground water resources and wildlife habitat. The human health effects of many agricultural practices/land uses have become a growing concern for many farm and nonfarm rural residents.

Nonfarmers are attracted to the countryside by the perception of a cleaner, aesthetically more pleasing environment than in a city or suburb. They may also be drawn by cheaper land and the potential to build a large house. Often, nonfarm newcomers are able to commute to jobs in suburbs and even cities. In this sense, they are trying to have the best of both worlds, a house in the country and a high-paying job elsewhere. It is common for newcomers to move to the countryside before they understand what life in the country and nearby agriculture are all about.

The Land Use TWP analysis used information from MPCA complaint records from June 1996 to March 2001 and newspaper articles in the two statewide newspapers (Pioneer Press and Star Tribune) from the period January 1, 1990 to December 31, 2000. These sources of data are imperfect. There are questions about the systematic collection and validity of each type of complaint data. In addition, the documented complaints surely underrepresented the number of actual conflicts that exist. For every conflict that is reported or noticed and documented, likely many more conflicts are never reported to or noticed by a third party. Because of the imperfections in the complaint data, a statistical analysis was not conducted. Instead, the complaints were evaluated on a gross level to observe if there are locations that are "hot spots" for complaints and for other patterns apparent in the data. Additional information on conflict associated with feedlots is presented in the chapter and TWP on Social and Community Impacts.

The following observations were made:

- Results of the literature review were confirmed, that an overwhelming percentage of reported complaints in Minnesota are odor based. A few counties appeared consistently as the locations for complaints.

- A total of 911 complaints about odors from feedlot operations in Minnesota counties were reported to the MPCA between June 1996 and September 2000. Three counties accounted for nearly 46 percent of the total complaints.

- Renville County registered the most complaints with 167 (18 percent), followed by Nicollet County with 150 complaints (14 percent) and Carver County with 100 complaints (11 percent).

- The newspaper analysis appears to support the earlier finding, based on the MPCA complaint data, of Renville County as a hot spot of feedlot conflicts.

- The TWP noted that both Renville and Nicollet counties saw dramatic increases in numbers of hogs per acre between 1982 and 1997.

- By species, hogs were the source of 65 percent of MPCA complaint records and 50 percent of the newspaper accounts. Complaints from swine operations outnumbered those from other types of operations in all but six counties registering at least five complaints.

- Odor was the cause of most MPCA complaint records; interestingly, newspaper accounts focused more on manure spills than on odors (54 percent to 23 percent).

Odor complaints are an excellent indicator of feedlot land use conflicts. Conflict often appears to involve expanding or changing livestock operations interacting with expanding suburban or rural nonfarm populations. To supplement the meager available data on conflicts, the land use team developed a set of indices to predict the potential for conflict in the rural landscape. The indices are forward looking, as these predict a certain level of conflict based on assumptions about the causes of conflict. For instance, the indices could be used to evaluate the effectiveness of new land use regulations in reducing conflict by comparing actual and predicted conflict from the point in time the land use regulation was implemented. The conflict indices are described in detail in the Land Use TWP, starting on page 34.

Nuisance and right-to-farm laws

An outgrowth of the concern over farmland loss to urbanization and the rising number of complaints by nonfarm neighbors against farm operators was a wave of state enacted "right-to-farm" laws in the 1980s. These laws were designed to protect farmers engaged in normal agricultural activities. Several manuals and reports have been published to assist producers in dealing with potential conflicts with nonfarm neighbors. Some have questioned the legal basis of these laws, asserting that they have radically restructured common law property rights.

The Minnesota law on nuisance (Minnesota Statutes, Section 561.19) finds that an agricultural operation is not considered a private or public nuisance:

- If the operation has been operating for two or more years and was not a nuisance at its start of operation, and

- When the operation expanded the number of livestock by at least 25 percent, or

- When there was a distinct change in the operation, such as from dairy to hog production that sought a permit modification.

However, the farm operation may be considered a nuisance if conditions or injury result from practices that are not normal farming practices or are in violation of state, federal or local laws, rules, permits and ordinances.

It has been suggested that the rationale for most of these laws - urban expansion into agricultural lands - may have been based on faulty assumptions. Size and type of farm and the community characteristics of the neighboring areas are more predictive of nuisance complaints and concerns than the actual population density or rate of population growth. Larger operations, livestock producers and farms located near areas that can be characterized as suburban, are more vulnerable to nuisance complaints

In September 1998, the Iowa Supreme Court ruled the Iowa Right-to-Farm Law unconstitutional. In February 1999, the U. S. Supreme Court refused to hear the Iowa case on appeal. As a result, it is likely that there will be challenges to the constitutionality of right-to-farm laws in other states.

Neighbor relations were considered by Palmer and Bewley (1999) in their examination of Wisconsin dairy operator expansions, which is also cited in the Land Use TWP. They found that between 1994 and 1998 the average herd size of those who expanded their operations had doubled. And while most (72 percent) expanded by adding on to existing facilities, those who were most satisfied with their expansion built all new facilities. However, producers who did not significantly change their dairy facility had better relations with neighbors than those with all new facilities. In other words, building all new facilities provided the greatest producer-perceived benefit, but adding on to existing facilities resulted in greater neighbor benefits. In addition, producers with larger herd sizes were more satisfied with all aspects of their operations: personal satisfaction, personal health, household income, family relationships, time away from the farm and overall quality of life, with one exception. Those with smaller herds were more satisfied with their neighborhood relationships.

Sources of land use conflict

Local land use decision-making is the forum used by the community to resolve conflicts such as those surrounding animal agriculture. A typical land use decision-making process includes the following steps:

- The issue/conflict is perceived;
- The issue/conflict is defined;
- Factual scientific information is obtained and reviewed;
- Stakeholders provide anecdotal and perceptual data to elected officials and staff;
- A solution is crafted and reviewed by stakeholders; and
- A solution is adopted.

This report addresses how the conflict is perceived and defined, and discusses possible solutions.

The sources of land use conflict identified in the literature include:

- Environmental concerns (odor, air pollution, water contamination, manure)
- Human health concerns
- Nuisances (both agricultural use vs. nonfarm rural uses, and small vs. large agricultural uses)
- Differing rural aesthetics
- Threat to traditional rural culture
- Use of land for agriculture vs. use for tourism/recreation
- Fear of property value reduction
- Fear of rural "brownfields" (contaminated sites that cannot be reused)

Scoping Question 2: What zoning and land use planning strategies exist, to what extent are they in place in Minnesota, and are they effective in:

a. Addressing the identified land use conflicts

b. Promoting citizen participation

c. Identifying and promoting the best uses of the land

d. Addressing development pressures in agricultural areas

e. Reducing negative environmental, economic, health and social impacts of animal agriculture

f. Balancing property rights

Most of the literature explains the planning and zoning process as applied to all agricultural land, but because many goals and conflicts over agricultural land are the same for animal agriculture, some of the strategies can be applied to animal agriculture. Documented strategies in the literature include comprehensive planning, zoning, local right-to-farm ordinances, and consistent enforcement of local regulatory strategies, land preservation and feedlot permit programs.

Land use regulation of animal agriculture

The issues involved in the land use regulation of siting and operation of concentrated animal feeding operations are many, complex and interrelated. In general, there are two main issues:

- Regulating the operation of new and existing feedlots, and
- Regulating the location and design of new feedlots.

Health and environmental regulations generally emerge from the state or federal government. Local land use planning and zoning are generally directed at regulating the location and design of new feedlots. The Role of Government TWP addresses the question of regulating animal agriculture at different levels of government. This chapter briefly addresses the authority of local land use control, what current land use strategies are in use and their effectiveness.

Legal issues are focused on the authority that local governments, including townships and counties use to regulate feedlots. The legal basis of local authority for planning and zoning are discussed in the Role of Government TWP. However, a brief discussion is warranted here. The Tenth Amendment to the U. S. Constitution gives state governments the power to exercise their police power to protect public health, safety and welfare. Local governments are the creation of the state government. The state government, through state zoning and planning enabling legislation, decides what powers of land use control to delegate to the local governments. Unlike other states, such as Iowa, **Minnesota does allow local governments to use zoning to regulate agriculture in general, and feedlots specifically.** (Minnesota Statutes, Section 394.25 (counties) and Section 462 (townships)). In addition, local governments may enact environmental and health regulations that prevent private property owners from creating public nuisances.

Another issue is the effect of zoning and other regulation on private property rights. The Fifth Amendment to the Constitution states that a government cannot take private property without paying "just compensation." A regulation is not a physical taking of property in the manner of a condemnation by use of eminent domain powers. Zoning and other regulations, however, can become a taking if they are unreasonable and result in taking all of the economic use of a property.

Obviously, tensions occur between the Fifth Amendment and the Tenth Amendment. State and federal courts continue to vary in their interpretations of these two amendments in land use cases. Nonetheless, the regulation of feedlots appears to have strong support as being in the interest of the public health and safety.

Finally, the Fourteenth Amendment to the Constitution requires due process and equal protection under the law. This means that governments must respond in a timely and procedurally correct manner for land use permits and decisions, and that all citizens must be treated the same. Governments cannot make arbitrary and capricious decisions. For example, a government could not delay indefinitely a decision on whether to issue a building permit for a feedlot. In Minnesota, however, a local government (in this case a township) may impose a moratorium on the permitting of new feedlots while drafting new zoning and environmental regulations (Duncanson v. Board of Supervisors (Minn. App. 1996)).

A report by the Minnesota Department of Agriculture summarizes the county ordinances in effect in Minnesota, including setbacks and separation distances, size limitations, thresholds for conditional use permits, minimum acreage requirements and manure application setbacks. There is virtually no literature assessing the effectiveness of various land use strategies to address conflicts over animal agriculture. Attachment 5 of the Land Use TWP includes a comparison of the MDA ordinance survey with setback distances generated by the University of Minnesota OFFSET model for calculating setback distances.

To quantify the causes and characteristics of conflict associated with animal agriculture, the land use team chose to assemble and analyze data on documented complaints. Documented complaints indicate that a conflict has risen to the point of being reported to or noticed by a third party.

Techniques for managing conflicts over feedlots

Although farms are attractive to look at, there may be some inconveniences and even hazards in living next to a large feedlot. A number of innovative techniques can, and in many cases are, being used to minimize conflicts between feedlot operators and both farming and nonfarming neighbors. The Land Use TWP team reviewed conflict management techniques used by local governments in Minnesota and beyond, as described in this section.

OFFSET: model to calculate setback (separation) distances. The Odor from Feedlots Setback Estimation Tool (OFFSET) developed by the University of Minnesota Biosystems and Agricultural Engineering Department, considers species, facility type, facility size, manure storage type and size and odor control technologies to estimate the necessary separation distance for livestock feedlots to achieve an "annoyance-free status" at varying degrees of frequency. Distances are estimated for sites with a prevailing "downwind" location. Separation distances for nondownwind locations will be overestimated with this tool.

The Land Use TWP (page 56) presents sample separation distance calculations using OFFSET for seven swine and two dairy facilities of various types and sizes. The results showed that setback distances suggested by OFFSET range from 0.03 to 0.3 miles for 91 percent annoyance-free levels, from 0.05 to 0.41 miles for 94 percent annoyance-free levels, from 0.1 to 0.75 miles for 97 percent annoyance-free levels, and from 0.28 to 1.92 miles for 99 percent annoyance-free levels. The TWP also compares the results to setback requirements in 43 county ordinances compiled by the Minnesota Department of Agriculture. According to this analysis, setback distances in existing county ordinances are fairly effective at attaining a 94 percent annoyance-free level for most site types.

In land use planning for livestock ordinances, there are three variables communities should consider:

- What level of annoyance is acceptable? This may result in unreasonable expectation for people living in an agricultural production zone if the agreed annoyance level in effect bans livestock production from the area.

- What setback distance is feasible in the planning area? For an area that is sparsely populated, a setback distance of 2 miles may be feasible; in this case, the community would not have to worry about annoyance-free levels or total odor emission factors, since all livestock site types would meet a 99 percent annoyance-free level. However, for most areas this large setback distance is not realistic – few locations would have so much land available for siting. In most agricultural areas, a setback distance of 0.5 miles or less would probably be more realistic. However, the shorter the setback distance, the more difficult it becomes to attain annoyance-free levels That is, the potential for odor annoyance increases.

- What total odor emission factors are reasonable for livestock sites? Some site types have very high total odor emission factors, and others have very low factors. For some site types, the total odor emission factor can be reduced by using odor mitigation technologies. Since the total odor emission factor affects what annoyance-free level can be attained at what setback distance, a community will want to determine a level that is attainable by livestock facilities while at the same time encouraging management that mitigates odor emissions.

These three variables must be balanced to meet community goals for both controlling odor nuisance and allowing livestock production in the area. Using OFFSET to explore various scenarios of the three variables could help all community members understand more fully the potential impacts of their decisions on themselves and other community members, and to devise a plan that can more fully meet all of their goals simultaneously.

Nuisance disclaimer. This disclaimer alerts potential property buyers (often nonfarmers) who are considering moving to an agricultural zoning district that residents in the zone may be subject to noise, dust, odors and other impacts from nearby farming operations. These impacts may cause discomfort or injury, and may reduce the enjoyment of one's property.

A nuisance disclaimer does not prohibit a new resident within the agricultural zone from filing a nuisance suit against a farm operation. However, the plaintiff will have been forewarned about the discomfort, and will have no legal standing unless a violation of a state or federal law is alleged. The disclaimer is meant to provide fair warning of potential conflicts, and thus discourage nuisance suits. It is important to keep in mind that agricultural zoning disclaimers refer to normal and legal farming operations. Farming practices that violate state or federal laws, such as water pollution from feedlot run-off, are grounds for lawsuits by nonfarm neighbors. The nuisance disclaimer is similar to the Land Use Notification form used by Morrison County, Minnesota. A copy of the Morrison County land use notification form is included in Attachment 6 to the Land Use TWP. A landowner applying for a building permit must sign and record the form with the county recorder. The form educates the landowner on the following points:

- Their land is in an agricultural district and feedlots and other agricultural uses are permitted.
- Feedlots and other agricultural uses may adversely affect the use or value of their land.
- Agricultural uses are given preference over other uses.

Local governments could also require developers to notify potential purchasers, in writing, if a feedlot is within a certain distance from the subdivision. Likewise, there could be a seller/realtor notification that would require sellers of any property to disclose to potential purchasers that feedlot is within a certain distance.

Deterrent to frivolous law suits. Michigan has gone a step further in defending farmers against nuisance suits. Michigan law requires a plaintiff who loses a nuisance suit against a farmer to pay the farmer's legal expenses. The law is aimed at discouraging frivolous nuisance suits that could pose financial hardships for farmers.

Resource management easements. A resource management easement may be required by local governments that issue permits to build a nonfarm residence in an agricultural zoning district. The resource management easement is a binding contract between the new resident and the local government in which the new resident agrees to give up rights to file a nuisance suit against farmers who are conducting normal or standard farming practices.

As in the case of the nuisance disclaimer, the resource management easement refers to normal and legal farming operations. Farming practices that violate state or federal laws, such as water pollution from feedlot run-off, are grounds for lawsuits by nonfarm neighbors.

The resource easement is recorded at the county courthouse and becomes part of the new resident's deed, before a building permit is issued and before any construction begins. Because easements run with the land, future buyers of the new resident's property will be subject to the conditions of the resource management easement. A sample resource management easement is included in Attachment 6 to the Land Use TWP.

Specialized agricultural zones. Agriculture as practiced today is often an industrial process involving the use of mechanical equipment, chemicals and heavy machinery. It is common for local governments to employ more than one type of industrial zone, based on the different types of manufacturing and the potential for spillovers of noise, dust, glare and chemicals from one property to another. Light manufacturing might be put in an M-1 zone, whereas more intensive, heavy manufacturing would be put in an M-2 zone.

Similarly, a local government could use different agricultural zoning districts depending on the intensity of livestock concentrations. For example, in 1999 Elkhart County, Indiana pioneered the use of agricultural zones to separate feedlots from other farming operations. The county amended its ordinances to add three agricultural zoning districts: A-3 Farmland Preservation District, A-4 Confined Feeding Protection District and A-5 Intensive Livestock Operation District.

A copy of the Elkhart County districts are included in Attachment 6 to the TWP. The details of each zone are explained in the Land Use TWP, beginning on page 65.

Large minimum lot sizes in agricultural zones. Agricultural zones with large minimum lot sizes, such as 160 acres (quarter section), will be better able to site new feedlots or accommodate the expansion of livestock operations if the feedlot is located in the center of the parcel. For example, the OFFSET setback estimation tool suggests that a 160-acre minimum lot size can provide a setback distance that can provide at least a 91 percent comfort level for neighbors of most feedlot operations. In Minnesota, Blue Earth and Waseca counties already have 160-acre minimum lot sizes in their agricultural zones.

A ban on certain technologies or feedlot set-ups. Certain feedlot technologies or barn arrangements may be preferable to others for controlling spillovers of odors onto neighboring properties. For example, in North Carolina, Smithfield Foods, the world's largest hog producer, has agreed to remove manure lagoons on the 276 farms it owns within five years. A county agricultural zoning ordinance could identify lagoons as a prohibited technology.

A cap on the number of livestock. A county agricultural zoning ordinance could place a cap on the number of animal units allowed. Rice County and some other Minnesota local governments impose a limit on the number of animal units at a site within agricultural zones.

Environmental history disclosure in permit application and reporting. Frederick County, Maryland, recently adopted a strict feedlot ordinance for swine operations with a provision that applicants must provide a three-year environmental history from any previous operations (along with various environmental safeguards and assurances). The goal is to prevent operations with a history of spills or other bad practices from locating within the county, and to monitor continually environmental practices of approved operations to prevent future problems.

Use of computer modeling to evaluate feedlot sites. Professor Patricia Norris at Michigan State University has been developing a tool for local governments to use in planning and zoning for feedlots. The tool is a computerized spatial decision system, combining geographic information systems spatial analysis with several criteria to evaluate the relative suitability of locations for feedlots. The tool is designed for "proactive" planning- that is, where feedlots should go, rather than reactive planning. The software system is currently being evaluated and may soon be available to local governments.

Conflict management: another tool for local governments. Land use regulations alone cannot eliminate conflicts between farmers and neighbors. A local government can play an active role in helping to resolve conflicts between neighbors before these conflicts polarize a community and leave a legacy of bitter feelings. Feedlot conflict management teams can be used to help minimize controversy. Building and maintaining trust among property owners is fundamental to a cohesive community that can rationally address and peacefully resolve problems.

Dairy feedlot programs in other states

The **Idaho Department of Agriculture** regulates dairy feedlots with annual inspections, regardless of size. Violations or unauthorized discharge of effluents can result in revocation of the farm milk permit. This program is considered the most stringent in the nation and effective at environmental protection. Meanwhile Idaho's dairy industry continues to grow.

Eastern North Carolina has seen tremendous growth in the hog industry (including both contract and corporate production facilities and meatpacking plants. Citizens there perceive an altered power structure, where the interests of large pork producers dominate those of constituents at all levels of government.

Neighbors of chicken-production facilities in **Texas** express a similar sentiment. While more than 90 percent felt the level of poultry industry regulation is not adequate, only 53 percent thought the government would increase regulations in the coming years.

In **Minnesota** surveys have found both farmers and nonfarming citizens dissatisfied with state agencies and local planning and land use regulations. Both groups suggested that state agencies need to work with people, and local elected and appointed officials need to base their land use decisions on 'facts and findings.' While there were otherwise clear differences in the perspectives of these two groups, there was clear consensus in their criticism of state and local government entities. Many producers are frustrated by the public's lack of trust or confidence in the industry. The perception of many farmers is that the environmental rules change so fast and the permit process moves so slowly, they just cannot compete on a national or international basis.

Legal basis for local land use regulation in Minnesota

In rural Minnesota three levels of local government exercise land use powers counties, townships and cities. Local governments in Minnesota exercise land use planning and zoning powers under express statutory delegation of police powers from the State of Minnesota. Delegation statutes for specific units of local government are:

- Planning and zoning for counties, Minn. Stat. §§394.01, *et seq.*
- Planning and zoning for townships and cities, Minn. Stat.§§462.01, *et seq.*

Under these authorizing statutes, local governments may adopt zoning ordinances to divide their community into districts that allow specific land uses and do not allow other land uses. Local governments may regulate the density of uses within a district, the location of structures on parcels, and the size of structures. A zoning ordinance may also establish performance standards for allowed uses. These standards may control on- and off-site impacts including odor, noise and dust. In order to make well-considered decisions and obtain sufficient public input, a local government may choose to place a moratorium on the siting of new feedlots. This gives the local government time to develop an appropriate ordinance. The time can also be used to inform people of the process and answer their questions with reliable information. The time must be used productively with a defined process and end goal, and not just as a cooling-off period.

Relationship between county, township and city land use ordinances

Cities lie within townships and townships and cities lie within county boundaries. Through statute, the state has established how the potentially conflicting land use regulations of these three jurisdictions relate to each other. If a county adopts a zoning ordinance, a township cannot adopt an ordinance that is inconsistent with the county ordinance. (Minn. Stat. §394.33, subd. 1) The township may, however, zone more restrictively. Within their boundaries, cities have exclusive land use authority. They can also choose to exercise some authority over rural areas in a surrounding township. Minn. Stat. §462.358 allows cities to extend application of their subdivision regulations to unincorporated territory located within two miles of city limits in any direction. As a counterbalance to this power, Minn. Stat. §462.3585 gives surrounding townships and counties the authority to require cities that invoke extraterritorial power to engage in cooperative planning for the overlapping jurisdictional area.

Because of the overlapping jurisdictions in rural areas, counties, townships and cities must work together to make land use decisions. In some instances, counties choose not to plan and zone at the county level. If feedlots are an issue for a single township or city, or a combination of townships, they have the statutory authority to address the issue. Townships may have local issues, needs and goals that reflect the larger community and the resulting ordinance may direct different choices than other townships or the county would make in similar circumstances. In some cases, counties have not wanted to enter the feedlot fray or feedlots have not affected the entire county area but rather concentrate in a few townships. This is the base reason for townships and counties both having land use powers.

Relationship of state and local land use regulation

Because local land use authority is derived from a delegation of state authority, it is possible for the state to preempt local action. The doctrine of preemption takes authority to act in a specific area of law away from the local government. Preemption occurs when the state so completely regulates an area that it leaves no room for local control. Even though the state has not asserted that its feedlot regulation has preempted local governments land use authority, the question of whether local governments can address environmental issues with their land use regulations is, however, open.

When local land use regulations attempt to address pollution or environmental issues, they begin to step into the realm of state action. Although the authority of local units to regulate feedlots independently in the area of environmental control is somewhat uncertain, the state has elected to share authority (under Minn. Rules 7020.0100) with counties in a joint feedlot-permitting program. As of 2000, 51 counties had accepted delegation of joint feedlot permitting powers.

Local authority in other states

Eight states were surveyed in September and October 2000 as part of the Role of Government TWP teamwork. The states were Iowa, Wisconsin, Nebraska, Missouri, North Carolina, South Carolina, California and Idaho. The surveyed states differ significantly on what authority local governments have over feedlot facilities. In Missouri local government involvement is reported to be uncommon, occurring only if the, concern involves human health. Iowa law exempts land and farm buildings from county zoning authority. Wisconsin county governments are involved on a zoning and ordinance level. South Carolina's counties are responsible for land use decisions and can regulate the location of facilities through zoning.

North Carolina, like Iowa, specifically excluded farms from county zoning regulations but the 1997 Clean Water Bill removed the previous zoning exemption for farms and authorized county governments to regulate hog farms and other agricultural facilities. Idaho's land use planning laws give counties authority to permit confined animal feeding operations (CAFO) facilities.

Local government regulation of feedlots in Minnesota

Most local feedlot ordinances in Minnesota contain a combination of the following provisions:

- Multi-tier agricultural zoning districts
- Separation distances from rural residences, towns, parks and other gathering places
- Setback distances from parcel boundaries, roads and other on-site structures
- Procedures and requirements for permitting feedlots as a conditional use instead of a permitted use
- Limits on the number of animals allowed per site or per a specified amount of land
- Public notice and public hearing requirements
- Design and management requirements for manure lagoons and earthen basins that go beyond MPCA standards
- Requirements for land application of manure
- Financial and land reclamation requirements for cleanup of abandoned sites
- 47 counties and several townships require conditional use permits for some feedlots, particularly large feedlots, feedlots with earthen basins or lagoons, and for feedlots within defined distances from water, cities or residences
- Many local governments require greater setbacks and separation distances for larger feedlots than for smaller feedlots determined by a sliding scale
- Some ordinances prohibit feedlots within areas of high environmental risk: floodplains, shorelands, wetlands, near drainage ditches, wells or sinkholes and on steep slopes
- Some ordinances establish requirements for manure storage facilities and setback requirements for manure application. A few counties require incorporation of manure within a day of application, and some require injection or immediate incorporation.

Although local governments have land use planning and zoning authority, many have not adopted comprehensive zoning ordinances. Controversy over feedlots has spurred several counties and townships to adopt zoning ordinances where the concept of zoning had previously been rejected by residents.

Scoping Question 3: What are the costs and benefits of these different land use strategies?

Literature quantifying the costs and benefits of different land use strategies as applied to animal agriculture is nearly nonexistent. As noted earlier in this report, and researched in the GEIS Literature Summary, Chapter F, External Benefits and Costs, the research on the cost and benefits of feedlot impacts on nearby landowners' property values is limited and contradictory.

There is, however, substantial literature investigating smart growth, the cost of public services and the fiscal impact of various types of urban development. These studies, including the most recent study by the Minnesota Department of Agriculture on cost of services, show that Anew residential development is more fiscally advantageous when it occurs within or adjacent to established urbanized areas.≅ Low-density residential development is more expensive than high-density development. The cost of services and fiscal impact studies are in virtual consensus. The conclusion that increasing density decreases societal, public or private costs is held by nearly every type of organization that has studied the cost issue.

Conflicts between farmers and neighbors typically emerge from a lack of communication, information or differences in attitudes, perceptions, beliefs, values or desires. The purpose of conflict resolution is to find common ground on which opposing parties can agree, and thereby avoid expensive and bitter litigation and long-lasting bad feelings. It is important to keep in mind, however, that conflict resolution may not succeed. It depends on the willingness of opposing parties to negotiate. An all-or-nothing attitude on the part of one party will prevent a satisfactory settlement. A negotiated resolution of conflicts is more likely when the stakes are small because legal costs are seen as much higher. Technically complex issues are often difficult to resolve through negotiation.
In rural areas, residents often look to local government for conflict management, not merely for regulation. Local governments have the opportunity, outside of regulation, to create conflict management programs or techniques to resolve feedlot conflicts. However, there are also benefits to having a state agency conflict manager. Section 4 of the Land Use TWP discusses the essential elements of a conflict resolution program, including the formation of a conflict management team led by local government staff but including other experts as needed.

Why land use choices are made at the local level

The statutory power to regulate land uses, including feedlots, is based on the belief that local governments are the best forum for resolving local land use conflicts. Local government most closely represents the people who are directly and continuously affected by land use choices. Local government is also the most accessible to citizens. There is some evidence that siting controversies seem to be most intense in states where county action is preempted by the state because county officials have little say over where feedlots are located.

Since land use conflicts most intensely affect residents at the county level, or smaller, this is traditionally where land use decisions have been made. Pollution concerns are more likely to affect people in a broader area: therefore, pollution control and enforcement has more often occurred at the state level.

Decisions at the state level are more likely to be standardized, not allowing for variations at the local level. Land use problems and solutions do not lend themselves to statewide decision-making. The state can establish goals and standards for land use planning, but the state cannot take into account the varying local history, culture, environmental and economic conditions that are critical to successful land use decisions. Local land use planning and zoning enable communities to move toward desired economic development goals in environmentally appropriate locations.

The land uses that lead to conflict change over time. Along with feedlots, currently there are local controversies over cell towers and off-road vehicle parks. No single controversial use has been the basis for changing the land use authority of local governments. The process for making land use decisions at the local level has been proven to serve local citizens well. Feedlots should not be a reason for changing local land use authority.

Interviews with selected counties

The Land Use TWP team held interviews with selected county feedlot staff. The procedural details are described in the Land Use TWP, beginning on page 58. The following points were observed from these interviews:

- Pennington County staff and elected officials view feedlots as a possible economic boost to the depressed agriculture economy. Because of their relatively dispersed population, they feel there are areas within the county where feedlots could be encouraged with low risk of complaints. Pennington County is currently working to have townships adopt feedlot ordinances that encourage the location of feedlots in “pre-approved feedlot zones.”

- Nicollet County recently began using the Odor from Feedlots Estimation Tool (OFFSET) as an aid in determining separation distances for feedlots located within the county. The county adopted revised feedlot regulations in December 2000, after six months of field-testing of OFFSET. Nicollet County Environmental Director and CAC member Tina Rosenstein strongly advocates the benefits of using OFFSET based on her experiences. In 2001, five additional Minnesota counties will be implementing OFFSET as part of a pilot program to examine the wider utility of this tool, developed by the University of Minnesota.

- Since August 1998, Morrison County has required a Land Use Notification form to accompany every land use permit for the construction of or addition to a dwelling unit in their agriculture zone and agriculture/forestry zones.

- Nearly all counties have undertaken specific outreach and educational efforts for producers to inform them of the ordinances regarding feedlots. Likewise, nearly all counties have taken steps to inform the general public about feedlots, as a means to reduce potential conflicts.

- Counties have made specific efforts to solicit input from producers and the public in developing or revising feedlot ordinances. All counties with ordinances held mandatory public hearings during the development and revision of feedlot rules and ordinances prior to adoption. Several counties held multiple meetings, beyond mandatory public hearings. They felt multiple meetings helped in the development and acceptance of the ordinances. There were few reported cases of intense reaction to the ordinances.

- Most county staff suggested that an approach based on cooperation avoided conflicts and complaints about feedlots. All, however, indicated their resolve in employing available legal authority to address egregious or persistent violations. Several commented that without strict enforcement for violations, other feedlot operators would become lax in complying with ordinances and rules.

- The sentiment of county staff was somewhat mixed when asked about the effectiveness of land use controls in reducing conflicts about feedlots. In most cases, they believed that having the ordinance in place helped raise awareness of relevant issues, as well as to set standards that producers could follow. In a few cases, though, they were not sure that the current level of regulation was adequate nor quantified overall benefits beyond what most people would consider reasonable, (such as, improved water quality).

- Specific suggestions from county staff for reducing conflicts included developing standards and rules that are clear and free of personal biases and unifying all enforcement levels through the counties, the MPCA or the federal government.

Interviews with selected townships.

Minnesota has 1,793 organized townships. The Minnesota Department of Agriculture ordinance survey (MDA, 1999) analyzed 34 township feedlot ordinances. The Land Use TWP team also interviewed officials in nine townships. Townships are active in adopting ordinances addressing feedlot issues, because the issue affects people at a local level. Township feedlot ordinances employ the same variety of land use tools as county ordinances: setbacks, separation distances, minimum acreages, agricultural districts, limitations on number of animals, and conditional use permit requirements. The following points are observed from these Land Use TWP interviews:

- Some townships had adopted feedlot ordinances in response to specific conflicts over a feedlot project.

- Communications among township officials, operators and residents before and after ordinances are adopted is important in reducing conflict . Communication before adopting the ordinance results in better ordinances. Communication after adoption results in fewer complaints.

- Setbacks and separations distance requirements were cited as reducing complaints.

- Townships discovered that when they adopted ordinances, they also faced potential liability in defending the ordinance. One of the township has had to defend several lawsuits.

- Several townships turned over control of feedlots to their respective counties. After adopting feedlot ordinances, these townships encountered liability costs and negative public opinion.

- Cost of administering feedlot ordinances can be too great for townships. Typically townships do not have staff and rely either on volunteer township officers or contract with county staff for ordinance administration. Some counties are not willing to administer township feedlot ordinances.

Model elements of a feedlot land use ordinance

Each local unit of government will have to consider carefully if each or any of the elements listed in this section is applicable to their unique local situation. There are often unforeseen consequences from any regulatory change. Based on the results of research on feedlot ordinance components in Minnesota and other states, the Land Use TWP team developed a set of model elements for a feedlot land use ordinance that could be used by any local government:

- **Use a participatory process for developing a feedlot ordinance.** A participatory process should involve residents, producers and representatives of all levels of local government. This type of process builds trust in the process and the outcome. It also can build ownership of the final product.

- **Base ordinances on comprehensive plan policies.** Comprehensive plans reflect the long-term goals and a vision for the character of a community. If ordinances are connected to a comprehensive plan, the ordinances will help reach long-term goals and not merely react to immediate, specific problems.

- **Try to be proactive, not reactive.** The timing of feedlot ordinances can contribute to promoting or reducing conflict. The worst time to solve a problem is after the conflict is roaring and positions are entrenched. If local governments try to address feedlots before they become problems, it may result in a more conscientious ordinance. Some counties and townships have suffered from thinking that if you ignore feedlots they will not happen or they will go away.

- **Identify potential areas of conflict and address these with ordinance provisions.** As part of the ordinance development process, local governments should identify potential areas of conflict and address these issues with specific ordinance provisions.

- **Spatial relationship of feedlots to other land uses and critical natural resources.** Local governments have employed setbacks and a number of other spatial separation techniques in feedlot zoning ordinances. These include

- **agricultural zoning districts or "large-scale" agricultural districts.** Standard agricultural zoning districts require relatively large lot sizes, but allow a mix of agriculture and nonfarm residential uses in close proximity. Local governments should consider designating a "large scale" agriculture district. These districts are based on the notion that large-scale agriculture is similar to industry and should be separated from other nonfarm uses. There is still a need to provide for separation distances and setbacks within a large-scale agriculture district because of farm residences and sensitive natural resources.

- **Large-scale agricultural districts as part of a tiered system of agricultural zones.** An example of a tiered system is included in Attachment 6 of the TWP. Minnesota courts have supported single-use zones that exclude other uses (*Connor v. Chanhassen Township*, 81 N.W. 2d)

- **Establishing separation distances and setback requirements.**

- **Notification and communication.** Notification and communication efforts can help moderate expectations and increase understanding that reduces conflict. Techniques used for notification and communication that have been discussed in this report include: land use notification forms that must be signed by people wishing to locate in an agricultural zone that allows feedlots, public hearings required for permit applications, and notification of neighbors about upcoming odor events.

- **Use of conditional use permits.** Local governments may require conditional use permits for feedlots that do not meet the minimum requirements of the zoning district. Conditional use permits offer local governments more opportunity to mitigate off-site impacts, such as odor and risk to water quality. The consideration of an application for a conditional use permit for a feedlot also requires a public hearing. This recognizes the need to consider neighbor's opinions in siting feedlots.

- **Manure management.** The odor and environmental risks associated with manure management are important land use issues addressed in feedlot ordinances. Manure management provisions that aim to reduce associated odor problems and risks to water and soil, can reduce complaints. Ordinances reviewed by the land use team included the following provisions addressing manure management: bans on certain types of storage, particularly open pits and earthen lagoons; requirements for filing of manure management plans; controls on land application of manure, including location - buffers from water and wetlands; time of year - don't spread on frozen ground; methods of application - incorporation requirements for liquid manure; and notification of neighbors about land application

- **Enforcement.** Enforcement provisions and programs are also important in the development of feedlot ordinances. Consistent enforcement based on clear rules will reduce conflict over time because operators will know what is expected and the consequences of not complying. Enforcement provisions need to identify who enforces and the consequences for non-compliance. The best laws, rules and ordinances are meaningless unless there is consistent enforcement of the standards, with penalties for nonperformance or violation.

Recommendations for further Land Use research

All the CAC consensus recommendations relating to land use are found in Appendix D of this document. A number of technical recommendations from Biko Associates staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional social, legal and environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on long-term land use patterns in Minnesota. It is important to document the precedents established in current litigation in order to understand how the courts are interpreting past and current legislation regarding the feedlot issue.

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Role of Government

This chapter examines the role of government in regard to animal agriculture in Minnesota. It looks at a number of government programs that affect feedlots including grants and loans, permits and enforcement, and environmental review as well as the efficacy of those programs.

The material in this chapter is based on the Role of Government Chapter C of the 1999 Literature Summary and the 2001 Technical Work Paper (TWP) on the Role of Government. The Literature Summary chapter presents an extensive listing of government laws and programs relating to animal agriculture and the reader is directed there for details on the information in this chapter. (Current Minnesota rules for feedlots that were not adopted until 2000. Detailed information on those rules is available from the Minnesota Pollution Control Agency Web site: ***www.pca.state.Minnesota.us***)

The appropriate role of government can be difficult to identify in the context of animal agriculture. Regulatory issues are intertwined with social , economic and environmental issues in very complex ways. The size and nature of farming operations is rapidly changing. There is a long history of special treatment for agricultural operations. Rural development patterns are bringing more nonfarmers in contact with farming operations. The controversy over animal feeding operations has been considerable and is likely to continue to be so. To reduce this controversy, government needs a more transparent, more integrated approach that relies on innovative ways of doing business.

The public sentiment on this topic was very strong. Many people feel that different levels of government responsible for regulating various aspects of feedlot operations need to cooperate more fully. Farmers are puzzled at the seeming duplicity of efforts and perceived lack of regulatory coordination among departments. Citizens feel that government departments are not taking their concerns and complaints seriously enough.

The format of this chapter is based generally on the study questions for the Role of Government topic contained in the *Scoping Document*. The Role of Government research was aimed at understanding the role of all levels of government related to animal agriculture, the regulations, policies and programs currently in place and their overall effectiveness in achieving desired goals.

Scoping Question 1: What are the government policies and programs directed at animal agriculture and human health as it is impacted by animal agriculture in Minnesota and other places including regulation, financial assistance and education or other incentives? How effective are these actions in mitigating problems or encouraging desired outcomes?

Throughout American history there has been a tradition of government support for and involvement in agriculture, generally aimed at achieving one or more of the following goals:

- Regulating farm prices and income
- Increasing production
- Maintaining a safe, inexpensive food supply
- Conserving and protecting the environment
- Correcting market failure
- Preserving family farming
- Addressing other social concerns

The most pragmatic reasons for government regulation of the agricultural sector involve the fundamental need to protect national security and public health through the provision of a reliable supply of food and fiber.

In recent times, regulatory policy has evolved from economic and business concerns of individual farm producers and consumers toward broader societal concerns such as farm structure, environmental issues and trade policy. Closely related is the shift in emphasis from purely domestic policies to the global setting of international agricultural commerce.

Farm programs and policies can be grouped as follows:

- Domestic farm programs
- Trade policy
- Marketing and demand expansion programs
- Food assistance, nutrition and safety programs
- Credit programs
- Disaster assistance and risk management
- Tax policy
- Regulation of conduct with animals
- Regulation of contracts and sales
- Corporate farming laws
- Organic and sustainable products and direct marketing
- Conservation and environmental programs

The following section outlines programs and policies in these areas, with greatest emphasis on the conservation and environmental programs. For detailed information about specific laws, regulations, programs and policies refer to the Role of Government chapter of the Literature Summary and Technical Work Paper.

Domestic farm programs

Domestic farm programs are designed to raise or stabilize farm prices and incomes. These programs include price supports, income supports and loan programs. These programs have historically provided billions of dollars annually to farmers. Typical commodity programs do not include livestock. Recently, however, the USDA has provided direct funds for hog producers. In 1999, $150 million was distributed to swine producers for special disaster relief. The amount was capped at $5000 per producer and was aimed at operations that sold less than 2500 hogs annually. Generally, farm program benefits have gone to large farms rather than modestly sized farms.

Trade policies

U.S. trade policy is designed to create a more favorable market for U.S. exports. Economists frequently argue that U.S. agriculture's fortunes depend on selling more products abroad. Certainly exports are important for animal agriculture. Meat exports increased significantly in the 1990s. By 1996 beef exports accounted for 7.4 percent of production, pork 5.6 percent, and poultry 16 percent.

Marketing and demand expansion programs

Several programs are designed to improve the producer's position in domestic and foreign markets. Four specific programs especially relevant to animal agriculture are:

- **Check off** Check off programs are designed to finance education, market development, advertising and research for a commodity. Funds for these programs are derived from fees paid by producers.

- **Cooperatives** The central role of agricultural cooperatives in animal agriculture would not be possible without special provision in federal and state law that permit and favor these entities. Federal statute waives some aspects of antitrust law for these organizations and tax laws favor them.

- **Grading and reporting by USDA** The USDA does extensive grading and standards analysis for agricultural goods. It also provides extensive information about prices and marketing.

- **Marketing orders** USDA maintains a complex system of milk marketing orders. In addition, individual states sometimes make efforts to regulate the price of milk.

Food safety

There are many federal and state food safety policies and programs that affect animal agriculture, covering such diverse areas as the regulation of biotechnology and inspection of meat, poultry and eggs. Further information and citations can be found in the Literature Summary chapters and TWPs on Role of Government, Human Health and Animal Health and Well-being.

Credit programs

Credit is a crucial aspect in all of agriculture, including animal agriculture. The government is engaged in efforts to make sure that adequate credit is provided for agriculture at a reasonable cost. Federal and other programs that aim to assist in lending are an important source of policy affecting the shape and character of animal agriculture.

Two important sources are the Farm Credit System and USDA's Farm Service Agency (FSA). In some cases, loan programs from the U.S. Small Business Administration can assist livestock farmers.

Farm credit system

FCS lenders are federally chartered banks and associations in the Farm Credit System, which make loans for agricultural purposes to eligible farmers, ranchers and cooperative associations. The FCS is granted certain advantages over other lenders in order to further lending to agriculture. FCS lending has been somewhat controversial because some think that FCS has been too aggressive in lending to larger hog operations in the Midwest.

Farm service agency lending

The Farm Service Agency (FSA) has actively made loans for family-sized farms. It is certain that there are many farmers—including those involved in animal agriculture—still in business because of these efforts. The FSA offers both direct and guaranteed loans. These programs are targeted for family farmers and beginning farmers.

Small business administration loans

Two loan programs are available to farmers from the U.S. Small Business Administration, the SBA 504 loan program and the SBA 7(a) loan program. The 504 loan is a direct loan of $50,000 to $750,000 through a "504 Development Corporation" which can be used for fixed assets. The 7(a) loan is a SBA guarantee of a bank loan of up to $750,000 that can be used for working capital, real estate or machinery. According to Minnesota Department of Agriculture officials, SBA loans have been instrumental in assisting Minnesota dairy farmers to finance their expansion projects.

Disaster assistance and risk management

Several federal programs are intended to assist farmers facing natural disasters and to manage the risk of low yields. Disaster payments generally are designed for crop farmers. A number of other programs have provided assistance to animal agriculture.

Tax policy

Although typically not acknowledged as a farm policy, federal, local and state taxation policies and U.S. monetary policy have a direct impact on animal agriculture. Most literature on taxes and agriculture are practical guides for farmers and tax advisers. A significant body of evidence, however, suggests that tax policy affects the operation and organization of U.S. agriculture in significant ways. Investment credit, accelerated depreciation allowances and interest deductibility provisions have promoted capitalization and high debt loads. Overall, tax policy seems to have encouraged farm expansion and reduction in the number of farms.

Regulation of conduct with animals

State and federal statutes regulate some aspects of the way farmers and others can treat animals. Legally, of course, animals are considered property. A number of articles that discuss the provisions of state anti-cruelty laws and proposals to strengthen provisions protecting animals from cruelty are cited in the Animal Health and Well-Being TWP. Further information is available in the Literature Summary chapter on Animal Health and the GEIS chapter on Animal Health and Well Being.

Regulation of contracts and sales

Contracting is increasing dramatically. Several articles cited in the Role of Government TWP examine the reasons for the increase but lack discussion on the policy implications of contracting. Contracts dominate meat production in the sectors of broilers, turkey and, to a certain extent, hogs. Additional information about contracting is found in the chapter and TWP on Economics.

Corporate farming laws

Several states, including Minnesota, have some form of anti-corporate farming law. This is usually done in an effort to protect the smaller, family farm. The Minnesota Corporate Farm Law includes an explicit statement of purpose:

> "The legislature finds that it is in the interest of the state to encourage and protect the family farm as a basic economic unit, to insure it as the most socially desirable mode of agricultural production, and to enhance and promote the stability and well-being of rural society in Minnesota and the nuclear family." (2000 Minn. Stat. § 500.24, subd. 1.)

The law places restrictions on the types of business entities that may either own agricultural land used to raise livestock, or produce livestock. While no court decisions have yet addressed this issue, some have argued that the law should also be interpreted to prohibit these business entities from owning livestock and raising it under a production contract. There are many exceptions to the law's general prohibitions for corporations, limited liability companies, pension or investment funds, or limited partnerships holding interests in agricultural land and farming. The law requires that business entities seeking exemptions to the prohibitions must provide detailed reports to the Minnesota Commissioner of Agriculture. Corporate farm law provisions are enforced by the Minnesota Attorney General's office through district courts, per 2000 Minn. Stat. § 500.24, subd. 5.

A detailed presentation of the Minnesota corporate farming law can be found beginning on page C-26 of the Role of Government chapter in the 1999 Literature Summary.

Organic and sustainable production and direct marketing

Organic and sustainable production has become an increasingly viable force in animal agriculture. Studies, beginning in the late 1970s, have argued that organic production can be competitive with conventional production. The feasibility of an alternative, sustainable method of pork production and policies that affect the prospects of organic and sustainable livestock production are likely to be important for an increasing number of poultry and livestock producers.

The Minnesota Department of Agriculture's Energy and Sustainable Agriculture Program administers grants and loans for demonstration projects that reduce farm inputs and improve energy efficiency or usable on-farm energy production. Grants are for a maximum of $25,000. Since program inception in 1989, it has funded 192 projects (out of 850 grant applications), at a total cost of over $2 million.

In addition to the grants and loans, the Energy and Sustainable Agriculture Program provides a clearinghouse of information on sustainable agriculture methods. It plays an important role in helping new ideas take hold, including ideas such as rotational grazing that hold promise for addressing some of the problems associated with feedlots. This program and others funded by the state such as the Minnesota Institute for Sustainable Agriculture, provide a basic infrastructure supporting agricultural sustainability.

Despite these programs, the concept of sustainable agriculture has yet to penetrate widely into mainstream agriculture, or even into the government's traditional agricultural programs. One bottleneck to the adoption of sustainable methods of agriculture may simply be the lack of technical assistance from the government. Currently, if a farmer wants to build a new manure basin, there is a well-developed system in place to make it possible. A team of engineers provided by the state Board of Water and Soil Resources and the federal Environmental Quality Incentive Program can design the needed changes if they help address environmental problems. If public engineers are not available, the farmer can get assistance from the private companies that design and construct such facilities. However, if the same farmer wants to implement a system of rotational grazing, for example, he or she will have a much harder time finding the necessary technical or financial help as the new practice is adopted. Many sustainable farming innovations involve changes in farm management rather than the purchase of an expensive new product or system. As a result, the private sector has less reason to step in and provide help, and the benefits of the government taking on this role instead are comparatively greater. The state could consider funding additional staff positions to provide this kind of on-site training and assistance needed to help producers develop alternatives to concentrated animal feeding operations.

Conservation and environmental assistance programs

In recent years, government has extensively pursued agricultural nonpoint pollution, and in particular animal agricultural runoff. The main focus has been voluntary programs intended to assist farmers in protecting environmental resources while maintaining viable farm operations. Some believe that conservation should be the primary purpose of farm program spending. Most observers agree that the role of government in the realm of environmental policy for animal agriculture is bound to increase in the near future. Conservation and environmental programs at both the federal and state level can be divided into financial assistance/incentive programs and regulatory programs. Currently there are well-developed programs in place to help a farmer build a new manure storage or feedlot runoff project, if the project addresses an existing environmental problem. State and federal cost-share, loan and engineering assistance programs can help design, construct and finance such projects.

Financial assistance/incentive programs

Three programs provide the bulk of the funding for most projects. These are: Agriculture Best Management Practices (AgBMP) loan program (run by the Minnesota Department of Agriculture); the state Cost-Share program (run by the Board of Water and Soil Resources; and the federal Environmental Quality Incentive Program (EQIP) run by the USDA Natural Resources Conservation Service .

AgBMP Program. The AgBMP program was launched in 1994, as an offshoot of the Clean Water Act to address nonpoint sources of water pollution. This program, administered by the EPA, provides capitalization grants to states. The grants go into a State Revolving Fund (SRF), along with a 20 percent state-funding match.

The program uses funding from the revolving fund to make zero-interest loans to local units of government, who in turn provide low-interest loans mainly to farmers to pay for the implementation of agricultural best management practices on their property. Best management practices are defined as those that best reduce water pollution from nonpoint sources. Local units of government review the applications and decide whether they include "best management practices" that will help meet local water planning goals. Loans to farmers have a term of 10 years; as they are repaid to the local unit they may be loaned out again as "second generation" loans. Funding for the AgBMP program has been quite unstable over the years, varying between $2 million and $10 million. A survey conducted in 1997 indicates a very high level of satisfaction with the program among borrowers, county contacts, and local lenders.

State cost-share program.

The oldest of the grant and loan programs discussed here, Minnesota's Cost Share Program was established in 1977 as part of a larger initiative focusing on protecting surface waters from erosion and sedimentation. It is part of the same law that established the Soil and Water Conservation Districts and is administered by the Board of Water and Soil Resources . It is BWSR policy to provide cost-share funding only to feedlots with fewer than 500 animal units. The Cost-Share Program will not fund more than 75 percent of a project. There is a $50,000 limit per project for state feedlot cost-share. Moreover, the total amount of state and federal grant funding for all sources must not exceed 75 percent. The additional 25 percent may be covered by low-interest loans like the AgBMP loans. Typically, farmers receiving state Cost Share funds have about 50 percent of their costs covered by Cost Share, another 25 percent covered by AgBMP, and cover the remaining 25 percent with their own resources (or services in-kind on the farm). To be eligible for funding, feedlot pollution abatement practices must be on an approved conservation practice list. This list is approximately the same as for the federal cost-share program (EQIP). About $2 million per year have been spent on feedlots for the last several years.

Observations on impacts and effectiveness of state funding programs

According to a February 2001 document, "Feedlot Financial Needs Assessment Report by the Minnesota Department of Agriculture, an additional $73 million in cost-share funding for construction will be needed over the next 10 years just to cover the estimated compliance costs for existing small- and moderate-sized facilities. Yet another $73 million is estimated to be needed for engineering assistance, manure management planning and manure handling and application equipment, costs not currently eligible for cost-share funding. These additional costs double the cost-share shortfall to $146 million. No reports on the environmental effectiveness of the state cost-share program were found in this MDA study.

USDA EQIP program.

EQIP, established in 1996 by the FAIR Act, may be the most important of the USDA programs. EQIP combines the functions of several other programs to encourage farmers and ranchers to adopt practices that reduce environmental and resource problems through targeted 5 to 10 year contracts providing education, technical and financial assistance. Congress authorized substantial resources for EQIP and required that half of all EQIP funds be devoted to conservation practices related to livestock production.

The EQIP program is administered by the Natural Resource Conservation Service (NRCS), with some assistance from the Farm Services Administration, both branches of the U.S. Department of Agriculture. EQIP is funded through the federal Commodity Credit Corporation, which also funds many other USDA conservation programs. It has been allocated $200 million through 2002; 50 percent of this funding must be spent on livestock operations. Large feedlots (generally those over 1000 Animal Units) are not eligible to receive any financial assistance.

Unlike the AgBMP and state Cost-Share programs, the EQIP program seeks to target its resources mainly within specific priority areas identified as being particularly sensitive or subject to significant resource problems. Priority areas are generally defined as particular rivers, creeks or bays and the land within their watersheds. In 2000, for example, 18 areas were identified as priority areas. Priority areas are selected each year through a process that begins with local SWCDs convening a local work group. At least 65 percent of EQIP's funds must be spent within the identified priority areas.

In 1997, when the first allocations were made under the new federal EQIP program, Minnesota received over $ 5 million. Since then, its share of funding has hovered close to $4 million. Around 40 to 45 percent of this has been spent on waste management systems such as manure storage structures. Additional sums have been spent on other livestock related activities, like advanced nutrient management and prescribed grazing systems, bringing total spending on animal agriculture to around $2.4 million per year in Minnesota since 1998.

Observations on impacts and effectiveness

Unlike the AgBMP and state Cost-Share program, the EQIP program theoretically treats all resources (soil, water, air, plant, animal, and related natural resources) the same. However, funding is focused within priority areas, which in practice tend to be based on surface water quality concerns. Moreover, only listed practices are eligible, though special permission could be granted to implement experimental practices. Those practices tend mainly to address traditional surface runoff concerns, not emerging air quality concerns.

Virtually all environmental grants for feedlots are provided to address concerns over surface water. Regulatory structures, and large pools of money, have been built up over the decades to address erosion and surface water concerns. Funding is not easily available to address air quality problems and would be difficult to obtain to address ground water problems that do not have a surface water component. This focus on surface water stands in striking contrast to the main source of controversy in rural communities, which is over air quality and odor, particularly near large hog facilities. It is not surprising that surface water runoff problems would first capture the government's attention. Surface water problems are very real, they can be severe, and they have by no means been solved. Moreover, when compared with air (and ground water) problems, surface water issues are more obvious, and more quantifiable. Air quality problems, especially odor, have been harder to measure, and the health and environmental impacts are less clear. Smaller farms in the past simply did not create the concentrations of waste and the potential air impacts that the larger new facilities can create. So, the focus on surface water problems over other problems (especially in some of the funding mechanisms), like air quality, is understandable. Still, this disparity demands attention if we want to be confident that government is pushing the industry in the wisest direction, and if we want to make sure that in solving one kind of problem, we are not simply creating others.

Having a more integrated, multimedia focus will also minimize the chances of the government being caught unprepared, as it was in the 1990s when it allowed the construction of large new hog feedlots with open lagoons and no methods of controlling the quite predictable odor and air quality problems that would arise. Clearly, the emphasis should be placed first on the environmental and health priorities rather than on what is most convenient to measure or the areas where grant funding might be available.

EPA regulation under the Federal Clean Water Act.

Some feedlots are subject to regulation by the U.S. Environmental Protection Agency under the federal Clean Water Act. In Minnesota, the responsibility for this regulation has been delegated by the EPA to the Minnesota Pollution Control Agency, which runs the program subject to EPA oversight. The federal law uses special terminology for what Minnesota calls a "feedlot," "Animal feeding operations" (or AFOs) are agricultural operations where animals are kept and raised in confined situations, where feed is brought to the animals. In concept, but not all details, this term is similar to "feedlot" under Minnesota rules.

Not all AFOs are subject to the Clean Water Act. Those that are, are termed "confined animal feeding operations" (or CAFOs). What makes an AFO a CAFO is spelled out in EPA regulations. Basically, there are three criteria by which a AFO becomes a CAFO:

(1) it has more than 1,000 animal units (as defined by federal regulations and not by state law where the numbers are different); (2) it has between 301 and 1,000 animal units and has a direct discharge of wastes through a man-made conveyance to U.S. waters; or

(3) it is designated on a case-by-case basis as a CAFO by the MPCA or EPA because of a site-specific water quality problem.

CAFOs are regulated under the National Pollutant Discharge Elimination System permit program as a "point source" of potential water pollution, as are all other point sources including industrial discharges and municipal wastewater discharges. As for all other classes of point sources, federal regulations have been developed that specify "effluent limits," or restrictions on the amounts of pollutants that can legally be discharged. In the case of CAFOs, the discharge limits are actually a prohibition on any discharge to U.S. waters except in the case of a rainfall event equal or greater than the 25-year or 24-hour rainfall event. (This is sometimes called the "zero discharge standard.")

The NPDES program uses the mechanism of permits to enforce compliance with the requirements of the program. As can be imagined, the task of issuing a permit to every point source in the country has been an unwieldy very large task, and some types of point sources have had a higher priority for permitting than others. Until recently, CAFOs were not a high priority with the EPA, or with the MPCA, and hence many CAFOs in Minnesota are still not permitted.

However, the EPA has increasingly focused on feedlot issues over the last five years, and in December 2000 proposed significant new regulations that would apply to all CAFOs. The proposal includes several important provisions.

- Proposes two options for defining concentrated animal feeding operations (CAFOs): option one would lower the current 1,000 animal unit threshold (using the EPA definition of animal units which differs from the definitions adopted by the Minnesota Legislature) to 500 animal units but designate smaller animal feeding operations as CAFOs only by designation of a permitting authority. The second option is to retain the current 1,000 animal unit threshold. However, feedlots over 300 animal units must certify that they do not discharge pollutants through manmade facilities or discharge pollutants into waterways or allow confined animals to come into contact with waterways (the conditions for becoming a CAFO).

- Adds land application area in the CAFO definition.

- Requires each CAFO to prepare and implement a site-specific nutrient management plan that is prepared or approved by a certified planner, identifies the nutrients generated at the facility, determines the amount of nutrients needed by the planned crop rotation, and establishes agronomic rates of manure application.

- Eliminates the 25-year, 24-hour storm permit exemption.

- Requires manure recipients to certify that they are land applying at agronomic rates or, in the alternative, the CAFO must maintain records of the manure transferred to other landowners.
- Requires routine inspections of production areas to ensure that wastewater and manure handling and storage are functioning properly.
- Mandates that CAFO operators determine the nutrient needs of their crops based on realistic yields, sample soil to determine nutrient content, and use phosphorus indices to determine nutrient application rates.
- Establishes setback requirements that would prohibit applying manure and wastewater within 100 feet of surface water.
- Adopts a zero discharge requirement with no overflow allowance for swine, veal and poultry CAFOs.
- Adds dry manure-handling poultry facilities and stand-alone immature swine and heifer operations to the NPDES program.
- Requires processors that exercise substantial control over contract growers to be co-permittees.
- Requires CAFOs to maintain its permit until the facility is properly closed including proper closure of manure storage.
- Requires permitting authorities to publish quarterly a list of CAFOs covered under a general permit.
- Requires permittees to submit a notice that they have developed or amended a permit nutrient plan.
- Applies the NPDES effluent guidelines to all CAFOs including operations with 1,000 animal units.
- Mandates all beef and dairy CAFOs and new swine, poultry and veal CAFOs to assess whether a hydrologic link exists from ground water beneath the feedlot to surface water.

EPA finalized its proposed new regulations in December 2001. The final regulations were modified substantially from the proposals due to the results of public comment.

Observations on impacts and effectiveness.

The U.S. Environmental Protection Agency has been increasingly active on issues related to animal feeding operations. This may help eliminate some concern that other states will capture business from Minnesota through their more lax regulations. On the other hand it threatened Minnesota's control over its own feedlot program causing the state program to differ from EPA's. Unless these differences can be resolved to EPA's satisfaction, the EPA could withdraw some or all of delegation the NPDES program from Minnesota. If this were to happen, the affected NPDES permits would have to be issued and enforced by EPA's regional office in Chicago.

The EPA and USDA jointly announced a Clean Water Action Plan in 1999. The plan is designed to emphasize control of nonpoint sources of pollution. The new initiative aims to work within the context of existing laws and programs. The plan places particular emphasis on the management of animal waste. The EPA will use current regulatory authority to address standards and permits for larger animal operations. The EPA and USDA have developed a unified national strategy to minimize the environmental risk and public health impact of animal feeding operations. The EPA and USDA published a unified national strategy for animal feeding operations in March 1999.

One notable aspect of the cooperation between the USDA and EPA is the perception of a significant culture difference between the two agencies when it comes to enforcing environmental laws for agriculture. The USDA is perceived as pro-farmer with a preference for voluntary programs. The EPA is thought to be pro-consumer, preferring command and control. There are indications, however, that USDA may be becoming a more conservation-focused department. In any case, additional regulation at the federal level probably needs to take into account the agency that will implement the regulatory or incentive program.

State regulation by MPCA.

The Minnesota Pollution Control Agency's feedlot rules were first adopted in 1971. They were amended in 1974, 1978 and 2000. The rules have been historically and remain focused almost exclusively on prevention of water pollution. The rule can be found at Minnesota Rules, chapter 7020. The rules can be viewed at the MPCA's Web site (at www.pca.state.Minnesota.us, under the topic feedlots), as can many helpful fact sheets about the implementation of the rules. A particularly useful guide is the MPCA publication, "Revised Feedlot Rules at a Glance" which provides a comprehensive review of the new rules in an easy-to-use format.

The new rules contain four major components: a registration program covering feedlots with less than 300 animal units (which comprise the vast majority of feedlots); permit programs, mainly for large feedlots; a county delegation program; and technical standards for design and construction, operation, closure and discharge. The rules apply to animal agricultural operations that are defined as "feedlots" buildings or lots intended for the feeding or holding of animals, designed as a containment area in which manure may accumulate or where the concentration of animals is such that a vegetative cover cannot be maintained; pastures are not considered feedlots. Different levels of requirements are imposed on animal production operations depending primarily on their size as measured in "animal units," a way of rating the manure production potential of different species. The size of a feedlot in animal units is obtained by multiplying the number of head of each type by the animal unit factor for that species found in the rules.

Note: A complication resulting from recent legislative action is Minnesota's animal unit factors and federal factors for some species. Fortunately, this is immaterial for the vast majority of feedlots since they are too small to be regulated by the federal government.

Under the new rules, anyone who operates a feedlot must comply with all provisions of the regulations. A major change reflected in the new rules is the decision to not require permits for all feedlots. Generally, feedlots of less than 300 animal units do not require permits provided they comply with technical standards in the rules (this is estimated to apply to close to 30,000 feedlots, or about 71 percent of all facilities in the state); feedlots of 300 to 999 animal units require a streamlined short-form permit for construction (expected to cover an additional 6,000 plus facilities or about 16 percent of all feedlots); and feedlots of 1,000 or more animal units (about 800 facilities) require either a federal National Pollution Discharge Elimination System or a State Disposal System permit. There are exceptions to these general provisions, mainly for feedlots with existing water pollution potential problems; the reader may consult the MPCA materials for details. The MPCA materials also provide details on various types of permits, and what information is required in the applications.

Whether or not a permit is required, all feedlots of 50 or more animal units, or 10 if shoreland, must be registered with the MPCA or the county if delegated. Registration provides basic information on the ownership, type, size and location of the feedlot. Feedlots included on recent county feedlot inventories that meet Level II or Level III inventory requirements can be automatically registered through the inventory.

Technical Standards in the rules, which apply to all feedlots whether or not these are required to obtain a permit or even register, are requirements for planning, design, construction and operation of feedlots, manure storage areas and manure handling. The standards are divided into the following sections:

- General requirements and notifications
- Air standards
- Water standards
- Location restrictions and expansion restrictions
- Transportation
- Livestock access to waters
- Closure of a feedlot
- Liquid manure storage areas
- Unpermitted liquid manure storage areas
- Poultry barn floors

- Stockpiling of manure
- Composting of manure
- Land application of manure and manure management plans

The rules also provide for the continuation of the county delegation program, under which counties may choose to implement the state feedlot rules for those feedlots under 1,000 animal units (those over and special cases under 1,000 units are regulated directly by MPCA). Presently, 53 counties participate in this program. In each county, a delegated feedlot officer carries out the following duties on behalf of the state: administer registration program; review permit applications and issue permits; inspect feedlots and manure storage for compliance; process complaints about feedlots; maintain records on permits, inspections and complaints; and provide assistance in completing registration and permit forms.

Observations on the MPCA feedlot program under the revised rules

While it is too soon to assess the results of the new MPCA feedlot rules, it is important to understand that they include some important tradeoffs. Given the large number of regulated facilities, tradeoffs are probably necessary to provide a rational management system.

The first tradeoff is clear: general technical standards in return for a streamlined permitting process. By trading permitting flexibility for permitting simplicity, the MPCA is able to establish some regulatory relationships with a very large number of facilities. For example, the registration process should allow much better tracking of the 30,000 smaller operations than the current spotty feedlot inventory approach. It sacrifices, however, the ability to set more stringent conditions for particularly hazardous locations or more lenient conditions for areas where the hazard is much less than normal. In addition, new technology that might significantly change the ability to manage environmental problems might not meet the technical standards in the rules.

The MPCA contends that the new feedlot rules do allow for new technologies and in fact encourages producers to explore innovative technology; further, if an innovative technology comes into widespread, successful use, it may become possible to dispense with some procedures required with innovative technology review. For the 36,000 animal feeding operations under 1,000 animal units the value of having good standards and a streamlined permitting process that does not chew up most or all of the MPCA and county staff time probably outweighs concerns about flexibility. Carrying this tradeoff to facilities above 1,000 animal units raises more concerns since flexibility to respond to specific conditions and new technology may be more important and the number of facilities is much smaller.

The second tradeoff in the MPCA rules is between speeding up permitting and opportunities for public involvement. No opportunity for a public hearing is provided for animal feeding operations under 1,000 animal units (and perhaps for those over 1,000 animal units which qualify for a general NPDES permit) that comply with the technical standards in the MPCA rules and that are not considered a pollution hazard (as determined by inspection by a county feedlot pollution control officer or agency staff),. Some feedlots under 1,000 animal units that meet the case-specific criteria for designation as a CAFO will be issued individual NPDES permits for which public notice is required. In addition, feedlots of less than 1,000 animal units could be subject to an Environmental Assessment Worksheet, for which there is an automatic public comment opportunity, or subject to an EAW petition, which provides an opportunity for some public input.

If an animal feeding operation proposes to construct or expand a facility to a capacity of 500 or more animal units, the owner is required to notify each resident and property owner within 5,000 feet of the proposed feedlot perimeter. However this requirement does not trigger any type of public hearing.

No matter how good they may be on paper, rules must be implemented to have any real effect. In addition, a credible threat of enforcement is important to protect the environment from the small percentage of people who will not comply with the law except for this threat, to ensure that regulations are taken seriously, and to ensure fairness and a level economic playing field. A good inspection program is a prerequisite to a sound enforcement program.

Neither the MPCA nor most of the counties interviewed in the TWP have systems in place to inspect feedlots to ensure compliance with permitting requirements. Inspections tend to be triggered by one of two events: application for a permit or a complaint from a neighbor. Only about 800 new feedlot permits are issued each year. Many do not involve an inspection. That means that citizen complaints have been the primary driver of the MPCA inspection and enforcement program, and complaints direct much of the county's attention as well. Once a violation has been detected by the MPCA, citizen involvement becomes minimal, but citizen involvement is crucial to detecting the violation in the first place.

The research done for the TWP surfaced several important issues related to enforcement. First, there appears to be a much greater fear among producers than expected given the actual number of enforcement cases initiated each year. This may be due to several well-publicized criminal enforcement cases involving discharges to water bodies brought by a few counties in the mid-1990s. These criminal cases may have created a sense that there was a high risk of enforcement for feedlot operators. The fact that farmers were not used to dealing with the MPCA or DNR conservation officers may have added to the apprehension. The reality is that MPCA has initiated only 86 enforcement actions over the last six years, an average of only 15 each year. Most cases have involved discharges to surface water or unpermitted construction. While some enforcement is occurring, the numbers indicate that it is relatively rare and that most farmers who obtain permits and avoid intentional direct discharges to water have little reason to fear enforcement. Some farmers noted the opposite problem; they knew about poor operations that received no enforcement attention. These farmers worried that poor operators gave the industry a bad image. Another concern that arose from interviews of state and county feedlot staff was a lack of public support for their inspection and enforcement activities. This is not surprising given the nature of the conflict surrounding animal feedlots and the level of legislative intervention restricting the authority of government agencies. The result may be reluctance to pursue enforcement options even when they are clearly appropriate.

In most cases, enforcement should only be pursued as part of a clear strategy. In addition, it should be seen as one of many tools that are used to address priority problems. Once the role of enforcement in the compliance management system is determined it should be communicated clearly to the public, to producers and to MPCA and county feedlot staff. This approach should reduce fear of enforcement, make clear what activities will not be tolerated, and provide a better sense to enforcement officials of when it is appropriate to initiate actions.

One strength of Minnesota's feedlot regulatory system is that it provides opportunities for the public to be involved in the regulatory process. The rights of neighbors to be notified of changes at a site, to participate in public hearings, to file confidential complaints to government agencies, and to otherwise get involved in feedlot related issues is established by state law, and sometimes by local and federal laws too. These laws are based on the premise that public involvement in the regulation of feedlots is a critical part of the regulatory process. However, a regulatory system that relies *too heavily* on citizen participation, and *too little* on informed government judgment and expertise can create problems.

Over-reliance on the public comes at a price: it divides communities, it cannot assure consistent levels of environmental protection, and it fosters a sense of resentment against government, among both the citizens who oppose feedlots, and the operators who run them; both groups share a perception that the MPCA is not exercising its own reasoned, scientific judgment, but merely responding to outside pressures.

Legislation adopted during the 2000 session explicitly linked the ability of the MPCA to enforce its rules for the smaller feedlots (those below 500 AU) to the availability of cost-share funding. This made the issue of financial assistance to feedlot operators more important than ever. Lacking evidence of an immediate public health threat, the MPCA may not require operators of feedlots under 300 AU to spend more than $3,000 without 75 percent cost-share, and feedlots under 500 AU cannot be required to spend more than $10,000 without cost-share of 75 percent of the upgrade, or $50,000, whichever is less. However, the cost-share funding needed to cover these upgrade costs is not currently available (see the section on AgBMP and state cost-share programs for details).

The effectiveness of the MPCA's feedlot regulation was examined in 1998 by the Office of the Legislative Auditor ("*Animal Feedlot Regulation, A Program Evaluation Report*,"). The study found several strengths, including the design standards applied to new or expanded feedlots, the monitoring of water quality at certain large feedlots, and the relatively new monitoring of air quality. It also found that the program had numerous weaknesses, including: a lack of timeliness in reviewing and approving permit applications; insufficient review of some permit applications; limited follow-up on expired interim permits; insufficient resources devoted to visiting sites prior to permit approval or during construction; insufficient oversight of feedlots once they are in operation, except in response to complaints; poor tracking of staff responses to citizen complaints; a weak but improving enforcement program; little or no meaningful oversight of delegated county feedlot programs; and the failure to update rules since the late 1970s.

Since this report, several developments have addressed at least some of the identified weaknesses, most notably a complete overhaul of the rules and an increase in staff devoted to feedlot matters.

Minnesota environmental review program

Chapters 5 and 6 of the Role of Government TWP covers in detail the Minnesota environmental review program with respect to animal feedlots in detail, including several cases studies of specific EAW reviews and how cumulative impacts are and could be addressed under environmental review. This section briefly summarizes the program as it applies to feedlots.

The state environmental review program is not a regulatory program in itself, but works in conjunction with the regulatory processes. It is actually a process for supplementary review of the environmental, and in the case of an Environmental Impact Statement, the economic and social impacts of certain proposed projects, including some animal feedlots. Minnesota environmental review procedures provide for the preparation of Environmental Assessment Worksheets and Environmental Impact Statements . EAWs are prepared using a standardized checklist-style form and are designed to provide a fairly brief description of the proposed project and the anticipated environmental impacts. A special customized form exclusively for feedlot EAWs was developed by the EQB in 2000 at the request of the Governor to expedite the preparation of a feedlot EAW. Although EAWs were designed to be brief, in practice the documents are sometimes quite lengthy. EAWs are also used as a decision-making tool to determine the need for a more detailed environmental study, the Environmental Impact Statement. The rules list mandatory categories for a wide variety of projects; which must prepare the required documents. The government entity that is likely to have the most regulatory authority over a project is assigned to be the Responsible Governmental Unit and is responsible for the preparation and distribution of the EAW or EIS.

An EAW is required for the construction of an animal feedlot facility with the capacity of 1000 animal units or more or the expansion of an existing facility by 1000 animal units or more. If the facility is located in certain sensitive areas, then the construction or expansion of a feedlot facility of more than 500 animal units requires preparation of an EAW. Certain small expansions or construction of new feedlots with limited numbers of animal units are exempt from environmental review. There are no mandatory requirements for preparation of EISs for animal feedlots. The current thresholds for an EAW and exemptions for feedlots were set by the EQB in 1999 after a contentious rulemaking process. The Role of Government TWP explains the changes made and their rationale.

An EAW may also be prepared for a small, nonexempt project if the governmental unit responsible for permitting the facility decides that the project, because of its nature or location, may have the potential for significant environmental effects. The responsible governmental unit, which may be either Minnesota Pollution Control Agency or a county, may make this decision based on its own knowledge or upon evidence presented in a petition signed by at least 25 citizens.

Although environmental review of feedlots has often been controversial, actually very few feedlots undergo environmental review. For example, the TWP researchers examined MPCA records from the beginning of 1993 to the end of 1997 and found that only 47 EAWs were prepared out of 3,767 feedlots that received permits -- or only 1.2 percent of the facilities permitted during that time. The vast majority of feedlot proposals do not involve an EAW and this is not likely to change.

Although in theory any EAW could potentially result in an EIS, none have been prepared for feedlots in over 20 years. In the last three years, courts have ordered an EIS for two projects, however work has been stalled pending legal appeals).

Observations on the effectiveness of Environmental Review.

For the small proportion of feedlots that undergo environmental review, the process has proved to be an effective way to disseminate information, involve a wide audience, develop information about potential environmental impacts, and recommend mitigation measures that are implemented into project development. The three main purposes for the environmental review process are well served by the EAW process according to the case studies in the TWP. First, the EAWs provide accurate information early in project development. Second, the EAWs provide an avenue for public involvement; it appears that an EAW may actually be beneficial for a controversial project. Third, the EAW process provides information that is used in permits. The EAWs frequently identify some issues regarding potential environmental impacts that can be mitigated.

The main use of information generated in the EAW process is for permit conditions. In the projects reviewed for the TWP, it was found that these mitigation measures are almost always pursued if the project continues to completion. In many projects reviewed for this study, new issues were raised, often by the public, during the EAW review. Public comment and concern also gives added weight to certain issues.

The EAW is the only statewide method available for significant public involvement in feedlots. There are some public notice requirements for some feedlot permits but the notice is usually limited to immediate neighbors and the audience is a significantly smaller than for an EAW distribution. Local governmental units also may hold public meetings to discuss local approvals (particularly if a conditional use permit is needed). However, notices and meetings regarding permits generally occur later in project development than EAW review and not all local governments use these processes for feedlots. The EAW is the only mechanism available to provide pre-permit project information to a wide audience.

Some feedlot producers perceive that environmental review can be or is often used by feedlot opponents as a weapon to stall or stop feedlot proposals, or to harass producers. Other producers believe that the alleged environmental effects cited by the opponents are imagined or exaggerated, serving merely as an excuse to bog the project down in an EAW or EIS process, and that the real motives of the opponents have nothing to do with environmental concerns.

This was one issue considered by a Special Advisory Committee on Environmental Review Reform established by the EQB and charged to develop by consensus a package of revisions to the environmental review process as it applied to all types of projects. The Committee met thirteen times between January 2002 and July 2002. Feedlot environmental review issues, especially the citizen's petition process, were a prominent topic of discussion. However, in the end the Committee was unable to agree on a package of reforms and made no recommendations to the EQB before disbanding.

Public Redress through the Court System

An additional government service related to the regulation of animal agriculture is the provision of the right to seek redress through litigation in court. Citizens with objections to the operation of feedlots may involve courts in two primary ways. First, if the feedlot is undergoing a permitting process, citizens may appeal the permit decision of the MPCA or the county, or if the project is one of the few that undergo Environmental Review, they may appeal decisions not to prepare an EAW or EIS. This avenue is generally only available for new or expanding feedlots, since this is when permitting requirements are usually triggered, and there is a decision to appeal. A computer search of Minnesota appellate court records between May 1996 and February 2001 shows only 17 feedlot permitting cases reaching the appellate courts. Of these, 11 involve farmers suing counties or townships, usually for denying them a conditional use permit. Farmers lost their suits in eight of these cases. The remaining six were brought by feedlot opponents, mainly trying to get the MPCA to block, or impose additional requirements on, new or expanding feedlots. Citizens lost five of these. Although there have been a number of legal appeals of EAWs, and especially, EIS need decisions over the past decade, none were successful until 1998. Since then, courts have ordered preparation of two feedlot EISs.

Second, citizens may bring a direct nuisance action against the feedlot, though like most agricultural states, Minnesota adopted a "right-to-farm" law in the early 1980s, which limits the applicability of nuisance laws to farms. Nuisance as a legal doctrine means an unreasonable and substantial interference with a person's quiet enjoyment of his property. Livestock production generally involves the storage and disposal of large quantities of animal manure with associated odors, insects and other problems. Because of this, many livestock producers are potential targets of nuisance actions.

As of 1988 every state, except South Dakota, had enacted right-to-farm laws. Most right-to-farm statutes are written to prevent a situation from arising where a person is farming and then people later move onto adjacent property (such as a new housing development on the edge of town) and bring a nuisance action against the farmer. Often, these laws are in the middle of the debate surrounding the increasing industrialization and scale of swine production. A 1998 review found that the great majority of court cases interpreting right-to-farm laws have resulted in rulings in which the laws ultimately did not effectively protect the farm operation. It found that right-to-farm laws do little good if they are not accompanied by effective land use planning efforts that try to limit the ability of nonfarmers to intrude into agricultural areas. Similarly, a right-to-farm law by itself will not keep a farm economically viable if the critical mass of other farms and related agricultural services are lacking or if a near-by market for the products is nonexistent. In two recent cases, courts found the right-to-farm laws in question constituted a legislatively imposed easement across the property of affected landowners. One court went on to state that this imposition constituted a "physical invasion" of the affected property owner's land, and thus a categorical taking of private property for public purposes without just compensation.

Minnesota's right-to-farm law states that a farm cannot be considered a nuisance after two years of operation, if it was not a nuisance when it began operation. This is intended to shield farms from suburban expansion, and the complaints of the newly arrived homeowners. There are, however, some major exceptions to this protection. If the farm expands by 25 percent or more, the two-year period begins again at the time of the expansion. Moreover, the protections do not apply if the nuisance conditions result from operations that are negligent, contrary to commonly accepted agricultural practices, or contrary to state or local laws or permits. The protection also does not apply to swine facilities over 1000 Animal Units, or cattle facilities over 2500 Animal Units. There are no size-based exclusions related to dairy or poultry.

Nuisance lawsuits against farms were exceedingly rare even before adoption of the right-to-farm protections, and there have not been any that reached the appellate level since their adoption. This is surprising, given the controversy surrounding new large feedlots, especially swine facilities, and the fact that the right-to-farm law does not shelter such facilities. It may be that citizens believe the right-to-farm law is actually broader than it really is. It may also be that these suits are nonexistent because odor is so often the nuisance at issue, and because of the perceived difficulty of proving an odor nuisance.

While "nuisance" is an inherently subjective concept and should not need to be quantitatively proven, courts may be reluctant to find damages or order relief based on a form of harm that cannot be photographed or recorded, and which is notoriously difficult to measure. Of course, any litigation is likely to be expensive, which may dissuade potential plaintiffs from proceeding with legal remedies to the perceived nuisance.

Another potential avenue of public redress against polluting feedlots would normally be the Minnesota Environmental Rights Act (MERA), which gives citizens the right to bring civil actions to protect the air, water and other natural resources from "pollution, impairment and destruction." However, by excluding "family farms," "family farm corporations," and "bona fide farmer corporations" from the statute's definition of "person," MERA effectively excludes feedlots from direct citizen action. Farm operations are the only operations in the state so excluded. The ironic result is that, while citizen involvement is more central to the regulation of feedlots than to the regulation of most any other industry, citizens have less ability to litigate directly against a feedlot than they do against any other industry.

Scoping Question 2: How, and to what extent, do the government actions and policies of the past, present and future affect animal agriculture relating to economics, profitability, size and location?

That government programs and policies have been an important influence generally on animal agriculture is well known. However, specifics on how the role of government has affected the economics, profitability, size and location of animal agriculture are difficult to ascertain.

Many factors influence hog industry location in the United States. The industry is now less tied to natural resources and more mobile. There is anecdotal evidence to suggest that the stringency of state environmental regulations can influence a firms' location choices. For example, some believe that Minnesota is known to have an unfavorable business climate for new or expanded feedlots due to permit delays, high costs of data for some permit applications or EAWs, threats of legal action and negative local attitudes. However, studies of the relationships between feedlot siting and the stringency of government regulation have not found a strong and consistent relationship. This is similar to results of past studies of industry siting which have found that despite the "conventional wisdom" that assumes a linkage between state environmental policies and firm location decisions, most empirical studies to date have found only weak and insignificant effects for manufacturing as a whole.

Agriculture has traditionally been classified as a material-oriented industry, in that it was bound to the location of the basic natural resources, such as land or feed. However, technological and institutional innovation in the livestock industry have changed this view of agriculture as material-dependent, and therefore, other factors may now influence location decisions of these facilities. A 1998 study by Mo and Abdalla attempted to determine the effect of stringency of state regulations on swine facility siting over the 1988-1995 period. This study found overall that the stringency of environmental regulations did not appear to impact hog inventory growth. The study did find that growth was more rapid in states with exemptions for agriculture from local zoning ordinances. Anti-corporate farm laws did not appear to slow growth, although the study did not attempt to measure the strictness of the various corporate farm laws. In interpreting these results for Minnesota, it should be noted that the study period preceded the time of the greatest "boom" in swine facility construction in Minnesota, which began around 1995.

Four reports mentioned here and fully cited in the Role of Government TWP give insights into the U.S. livestock industry. Osei and Lakshminarayan reported a similar regression analysis of the U.S. dairy industry in which they looked at the probability that a given county would experience an increase in dairy farm numbers between the two census years 1987 and 1992. Variables included: milk price, feed costs temperature and precipitation, land value, population density, surface water density, and four variables characterizing the stringency of environmental policy. The economic variables of milk price, feed costs, and land values had the expected effects, with higher milk prices encouraging farms to locate in the county while higher feed costs and land values discouraged location. The four environmental variables (air quality, ground water policy, soil conservation, and an aggregate environmental policy index) all reduced the probability of location, although when population density was introduced as a variable along with each of the environmental variables, the separate effects of the environmental policy variables were still negative but of lesser magnitudes. This was especially true for air quality policy.

Metcalfe (1999) also examined the effect of increasing environmental regulation on the location of hog production in the U.S. The results suggest increased regulation has no significant effect on the location of hog production. The amount of hog production occurring on small operations seems most responsive to differences in the traditional input and transportation costs, while production on larger operations is being drawn to states with existing transportation and agricultural infrastructure.

An empirical analysis of dairy farms' cost of compliance with 1993 U.S. Environmental Protection Agency standards was reported by Outlaw and colleagues. They did an analysis of budgets for a number of representative farms using their Farm Level Income and Policy Simulation Model. They looked at several dairy farm sizes in different regions of the U.S. The did not study Minnesota, but for Wisconsin they found that minimum capital investments for compliance ranged from $20,000 on a 50-cow farm to $40,000 on a 175-cow farm and that moderate-size dairies were affected more adversely than large-size dairies. Dairies that were already in financial trouble could be put out of business by requirements to conform with EPA standards. Many of these dairies, however, could go out of business regardless of the EPA requirements, albeit at a later date. Large-scale dairies that were not already in financial trouble appear to be able to amortize the extra capital investment costs associated with meeting the EPA requirements. This suggests that moderate-size dairies faced with needing to make investments to meet the EPA standards may choose to expand the scope of their operations, if financially able. While such expansion would require an even larger investment, it also would hold the potential for making the dairy more efficient and competitive.

Leatham (1992) evaluated the impact that Texas water quality laws have on dairy profitability and survival. Results showed that representative 300- and 720-cow dairies would incur additional annual costs of $60 and $81 per cow, respectively. Compliance with water quality laws reduces net farm income by 27 percent and 63 percent for 720-cow dairies with low- and high-debt positions, respectively.

Scoping Question 3: How are public funds for animal agriculture research, education and training currently allocated in Minnesota and how does the allocation of these funds affect the development of animal agriculture and Minnesota citizens as a whole?

To conduct the literature summary review, Question 3 was divided into two parts. Researchers on Question 3a searched for literature that documented how public funds for animal agriculture research, education and training currently are allocated in Minnesota. For Question 3b, researchers focused on literature regarding the impact that the allocation of funds has on the development of animal agriculture and Minnesota citizens as a whole.

There are relatively few pieces of literature that address either Questions 3a or 3b. In answer to Question 3a, the researchers compiled information about public funds for animal agriculture that are received by the University of Minnesota. Some information about other federal funds allocated to research on animal agriculture in Minnesota has also been complied. In answer to Question 3b, no literature that addressed the impact of the allocation of funds on Minnesota was found. Some documents addressed the impact of fund allocations at a national level. The reader is referred to the Literature Summary for a description of the allocation of public funds for animal agriculture issues at the University of Minnesota and a summary of the impact of fund allocations at the national level. It is clear that many issues raised in this Generic Environmental Impact Statement will require additional funding to conduct ongoing data collection and research. There is a public sentiment that research conducted by land grant universities should be more basic and untarnished by funding from industrial groups with special interests.

Scoping Question 4: What are the implications of regulating animal agriculture at the township, county, state and federal level?

There is sparse literature available to answer this question. A few studies by agricultural economists have approached the question on the periphery, but not directly.

Abdalla and Becker examine the jurisdictional boundaries of governmental agencies that regulate agriculture in a 1998 article. Conventional wisdom suggests that local governments are closer to and are therefore more in tune with local conditions and citizen preferences. However, regulation at a higher level of government can help create a "level playing field" for competition among firms or to assure that everyone receives a certain minimum level of a public good or service. Abdalla and Becker look at several case studies where animal agriculture issues were controversial and where the question of jurisdiction became a concern. They conclude that there are no clear-cut guidelines to identify which level of government is best equipped to deal with these conflicts. The level of government that has the political support to do so should take action.

In another 1998 study that looks at jurisdictional boundaries, Theresa Heil points out that smaller livestock facilities and various types of agricultural sources of pollution, such as discharges from agricultural storm water runoff, are not regulated by the federal government. While Congress felt that nonpoint source pollution could best be addressed at the state level, there are problems at that level too. Heil notes that farmers often cannot easily pass the expenses of nonpoint source pollution reduction on to their customers. In addition, the effects of the nonpoint source pollution are often felt most heavily downstream from the source, reducing the pressure on local governments to establish and implement nonpoint source control initiatives. The Wisconsin Legislature developed a statewide initiative for agricultural pollution control; however, even that has proved ineffective in some cases,

Heil states. Nonpoint source regulations, to be effective, must be implemented at the local level via local agencies with incentives for farmers in the form of financial assistance.

Mo and Abdalla found that the capability of local governments to regulate the swine industry through local zoning ordinances appears to have affected growth of the hog industry. This result supports the argument that in states where local governments have legal authority to regulate the hog industry, the regulatory environment is less uniform and perhaps unstable.

Recommendations for further Role of Government research

All the CAC consensus recommendations relating to Role of Government are found in Appendix D near the end of this document. A number of technical recommendations from Decker and Paddock staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional social, legal and environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on the Role of Government in Minnesota.

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ECONOMICS TOPICS

The GEIS Scoping Document included three separate topics under the general heading of economic impacts: D. Industry Structure and Competitiveness; E. Profitability and Economic Viability; and F. External Benefits & Costs. Because during the Literature Summary preparation in 1999 it was determined that there was much overlap between the information on topics D and E, those topics were combined in that report into a single chapter. Because of the dearth of information on external costs and benefits, that topic has also now been combined into the same chapter, so that this chapter covers all Economics topics.

In the GEIS comments received from the Department of Agriculture, Commissioner Gene Hugoson states, "It is important for all readers to recognize the fundamental social and economic importance of Minnesota's livestock industry. Throughout its history Minnesota has depended on agriculture as its economic backbone. Despite the urbanization of the state, agriculture remains an economic cornerstone - particularly in rural communities." ….

"Agriculture food and fiber sectors generate roughly 17 percent of Minnesota's annual Gross State Product. Minnesota agriculture annually brings more than 16 billion dollars into the state through domestic and international exports. One out of every five jobs in Minnesota is in the agriculture and food sectors. One out of every three jobs in rural Minnesota is in the agriculture sector. Each farm production job helps to create an additional three jobs in all economic sectors. Together , the agriculture and food sector are the second largest employer in the State. " ….

"The facts demonstrating the importance of agriculture to our economy must be provided as a background if future readers are to have an accurate understanding of what is at stake when discussing the state's agriculture industry. Because animal agriculture is so important to our state's economy, a number of people have encouraged that government at all levels conduct an accurate and through cost-benefit analyses before adopting any significant new regulations. To survive in today's global marketplace, Minnesota farmers must compete directly with producers in other states and countries." … Commissioner Hugoson's entire comment letter can be found in Appendix E, along with all written comments received from other state agencies, various industry and public interest groups and many concerned citizens.

The material in the Economics technical work paper was supplied by the Agricultural Economics Department at the University of Minnesota. While a number of reviewers have criticized this section as providing inadequate information, the University economists insist that there is a lack of suitable, peer-reviewed, high quality information available to adequately answer the Scoping questions. A great deal of additional economic information on farm operations is available from the Minnesota Department of Agriculture at their Web site, http://www.mda.state.Minnesota.us/.

Economic topics were a fundamental concern to many commenters. Any holistic analysis of animal agriculture in the state of Minnesota must include recognition of the fundamental economic, social and historical importance of livestock production to the state economy and way of life. One cannot ignore the importance of agricultural sales and employment in the entire state, but especially the non-metropolitan region.

The remainder of this chapter is primarily descriptive of the major topics explored in the Economics TWP and the Economics sections of the Literature Summary. Because of the overlaps between the Scoping Study Questions of topics D and E, this chapter of the GEIS is not organized according to the Scoping Study Questions. Information has been regrouped to provide a smoother flowing narrative under other topical headings, although each Study Question is addressed somewhere, to the extent that information was found related to that question

However, despite the importance of the economics topics, many of the Study Questions could not be answered in any definitive way. This was especially true for Study Questions under topics E, Profitability and Economic Viability and F, External Costs and Benefits. The first cause of this information shortage is that there were few rigorous studies available of the economic effects of the recent trends in animal agricultural production; this limited what could be learned through the 1999 Literature Summary report. To try to fill in some of the important information gaps, the EQB and its Citizens Advisory Committee developed a work program for additional studies in the economics areas, but received no responses to the Request for Proposals public notice for most of the economics work. Therefore, several of the most important work tasks for the economics questions could not be carried out. There included: (1) a comparison of different forms of livestock production with respect to profitability and viability; (2) a comparison of the external costs of different forms of livestock production systems; and (3) a study of the transition occurring from a commodity-based system to a system of differentiated markets for livestock including factors that would assist producers in making the transition. Good answers to many of the Study Questions will have to wait until additional research is done.

Organizational Options for Minnesota Livestock Producers

Most Minnesota livestock operations are organized as single-family, sole proprietorships where the farmer and/or the farm family that owns the production or owns, or leases, the productive assets provide day-to-day labor and management. Single-family sole proprietorships, while they are common and have a rich heritage, are not the only way to organize the capital, land, labor, and management decision making required for agricultural production. There are other options, as well. The range of options for organizing and financing a business has expanded considerably in recent years due in part to innovations in financial markets and in response to liability, taxation, and asset transferability issues. Some livestock producers are utilizing these various options in order to finance the capital needs of larger facilities while sharing control, returns and risks among multiple owners, employees, and other stakeholders.

The choices and options include legal organization, business arrangement, leasing options, and sources of both equity and debt capital. Legal organization options available under Minnesota law include the following:

General Partnership – A partnership that has two or more owners who carry on a business and who share in the profits or losses. Each partner is held liable for the full debts of the partnership if the partnership is not able to pay its debts. The partners can all participate in the management and each partner can bind the partnership to contractual obligations.

Limited Partnership – The limited partnership has at least one general partner and at least one limited partner. The general partners are liable for the full debts of the partnership. The limited partners are not liable for the debts of the partnership unless they have personally guaranteed the partnership debt or are liable as a result of individual action other than being a limited partner. Limited partners are not allowed to participate in the management of the partnership business.

Limited Liability Partnership – This entity has an unlimited number of shareholders, but only natural persons, partnerships and other entities certified under the corporate farm law can participate. Partners may elect to have some of the partners have less than joint and several liability.

Family Farm Corporations – These entities have a number of shareholders, but the majority of the interest and the majority of the shareholders must be related within the third degree of kindred. Eligible shareholders include partnerships, natural persons, limited partnerships, and limited liability partnerships.

Authorized Farm Corporations – Eligible shareholders must be natural persons. Shareholders are limited to five, but no relation is required. Limited liability is offered in this structure. As a general rule, a corporation is a tax paying entity, but it depends on whether the corporation is organized as Subchapter “C” or Subchapter “S.” Dividends paid to shareholders, however, are fully taxable.

Family Farm Limited Liability Company – These entities have a number of members, but the majority of the membership and the majority of the members must be related within the third degree of kindred. Eligible members are natural persons and partnerships. One of the related members must actively operate the farm. Can be formed by just one person.

Authorized Farm Limited Liability Company – Eligible members must be natural persons. Members are limited to five, but no family relationship among members is required. As a general rule, an LLC is structured like a corporation, but taxed like a partnership. Can be formed by just one person.

Limited Liability – LLCs, LLPs, corporations and limited partnerships are all forms of limited liability business structures. "Limited liability" means that, as a rule, an individual having an interest in one of these business structures is not personally liable for the business' debts beyond the extent of his or her ownership interest. Individual liability may occur, however, if an owner executes a personal guarantee or engages in fraudulent behavior to such an extent that a court will "pierce the corporate veil" and hold the individual liable for the company's debt.

Business arrangement options in addition to the traditional independent production include production and marketing contracts, joint ventures, and strategic alliances.

Table 1 at the end of this chapter presents a table summarizing the various business, legal, and financial options available to Minnesota livestock farmers.

Legal organization choices are regulated in Minnesota and many other states.
In Minnesota, Statute 500.24 places limitations in the amount of farmland which a corporation can own. Corporations are prohibited from engaging in agriculture, except for family farm corporations and authorized farm corporations. Certain other exceptions to the prohibition also apply. The regular business corporation laws apply to farming in the same way that they apply to other businesses.

General Economic Trends in Minnesota Animal Agriculture

The major shifts in the Minnesota livestock industry in the 1990s are that cattle and sheep numbers are down while hogs, layers, and turkeys have shown growth. Consolidation of livestock production onto fewer farms is very evident in the hog and dairy farm numbers. The number of operations with hogs declined by 46 percent between 1993 and 1999, while dairy operations declined by 33 percent over that six-year period. The number of sheep operations was down 44 percent over the same time frame. Minnesota has been losing national market share in beef cow-calf and cattle feeding operations, while our pork industry share is increasing. Not much change is evident in the number of cow-calf operations, while the number with cattle on feed declined by eight percent from 1993 to 1998.

Number of Farms, Farm Size, Tenure, Marketing, Farm Income

Farms are consolidating and changing the ways in which they acquire resources and manage risks. The total number of U.S farms peaked at 6.8 million farms in 1935. By 1997, only 1.9 million remained. Average acres per farm increased from 155 acres in 1935 to 487 acres in 1997. Most U.S. farms are organized as single proprietorships. Family and non-family corporations were 4 percent of the farms in 1997 but had 29 percent of the gross sales. Land leasing has changed from a way for beginning farmers to enter agriculture to a way of gaining access to additional assets. This allows farmers to avoid debt and risks associated with ownership, and to be able to respond more quickly to changing market conditions. Farmers have become more reliant on production and marketing contracts over the past 40 years. Eleven percent of U.S. farms had at least one marketing contract, but these farms accounted for 40 percent of the gross sales.

Farm operator households typically receive income from several sources, and 88 percent of their household income came from off the farm in 1997. The relative importance of off-farm income varies widely among different farm types.

Terms of Trade

Terms of trade between agriculture and the rest of the economy are a longstanding policy issue. Past discussions of terms of trade have focused on price parity. Rates of return on assets or equity capital are a better measure of trade terms because rates of return capture technological change over time. Rates of return for Minnesota farms appear low compared to U.S. manufacturing corporations and food processors and retailers, because all manufacturing corporations averaged around 12 percent return on equity over the ten years, 1991-2000, while farms in the Southwestern Minnesota Farm Business Management Association averaged a return of around seven percent. Data for food processors and retailers were available only for 1990-96. Over that period, food processors averaged a 17 percent return while food retailers averaged 14 percent. On the other hand, a recent comparison of U.S. farm households versus households with nonfarm businesses showed a different picture. Median rates of returns in 1997 for the farms were comparable with the returns of nonfarm businesses, when farmland capital gains were considered. Large farms earned greater returns than did the nonfarm businesses. The nonfarm businesses also experienced more volatility in returns.

Hogs

Competitiveness

Minnesota and the rest of the Upper Midwest appear to be strong world competitors in pork production. Studies show inconsistent results about the Upper Midwest's competitiveness versus the southeastern states. Recent cost and return estimates from the USDA Economic Research Service show an advantage for the Southern Seaboard region over the Heartland region in 1999, in contrast to other studies which showed the U.S. and Canadian plains states and regions as having the lowest costs. The Canadian prairie provinces, Argentina and Brazil are the main competitive threats that have been identified that could challenge the U.S. in world trade.

Consolidation

Nationally, consolidation of the pork industry is continuing. The changes are occurring primarily in the largest and smallest groups of producers. The largest operations are gaining the greatest market share and the very smallest are showing the greatest loss. There were 18 operations marketing 500,000 or more pigs per year in 1997, representing 24 percent of total U.S. slaughter. At the other extreme, five percent of U.S. hogs were marketed by approximately 80,000 farms selling fewer than 1,000 hogs annually.

The 7,500 Minnesota operations with hogs in December 1999 are down by almost half from the number with hogs in 1993. There were 17 percent more hogs and pigs on Minnesota farms in December 1999, compared to December 1992. The pig crop also increased since 1993, but both the pig crop and December inventory saw declines between 1998 and 1999.

Production Enterprise Types

An analysis of the swine enterprises participating in the Minnesota State College University Farm Business Management Program and the Southwestern and Southeastern Minnesota Farm Business Management Associations (MinnesotaSCU-FBMA) over the four years 1996-99 shows that swine production is moving rapidly away from farrow-to-finish toward systems where pigs are farrowed in a separate enterprise, in large, centralized sow units and often located outside of Minnesota. In 1996, half of the hogs sold came from farrow-to-finish enterprises while only 25 percent were sold from that type of enterprise in 1999. The number sold from wean-to-finish enterprises tripled, from 4 percent to 12 percent, over the four years, while the number in production contract enterprises rose from 13 percent to 31 percent. Independent finishing of feeder pigs has held steady at about one-third of the total marketings, but these finishing enterprises have declined in number and increased in size. In shipments of pigs into Minnesota were 23 percent of marketings in 1999. These in shipments were triple the nine percent share of marketings in 1995, five years earlier.

Production Volume

Despite the decline in the number of farrow-to-finish enterprises, they are still providing about half of the total net returns generated by these swine enterprises. It is notable that more hogs were transferred from the contractee enterprises in 1999 than were sold from the farrow-to-finish enterprises, and nearly as many as from the feeder pig finishing enterprises. Despite the volume, the contractee enterprises contributed markedly less to the operations' net returns over the four years than did the other enterprises.

Financial Performance

Specialized Minnesota hog farms suffered significant financial losses in 1998 after two good years in 1996 and 1997. A modest level of profitability returned in 1999, but debt is still at higher levels than before the downturn. These financial stresses have accelerated the consolidation and production system changes that were already underway in the mid-1990s.

The decline in farrow-to-finish and independent feeder pig finishing enterprises and the increasing numbers of wean-to-finish and contractee enterprises may be at least partially explained by their relative financial performance. Wean-to-finish enterprises have been riskier but more profitable than contractee enterprises were over the four years, but both offered advantages over the more traditional farrow-to-finish and independent feeder pig finishing enterprises. Hourly earnings of the wean-to-finish enterprises averaged higher over the four years compared to the farrow-to-finish and independent feeder pig finishing enterprises, with lower risk as measured by the standard deviation of annual returns.

The contractee enterprises provided the lowest average hourly earnings, more than two dollars per hour less than for farrow-to-finish and independent feeder pig finishing, but did not experience the losses that the others suffered in 1998. Aside from the lower variability of annual returns, other explanations that have been put forth for the increasing popularity of contractee enterprises are the minimal skill required to manage finishing animals compared to a breeding herd, management assistance provided by contractors, and ease of financing due to the reduced income variability.

Independent feeder pig finishing is a high-risk enterprise. In 1996 the largest size group averaged a return of $88 per hour, but lost money at a rate of $32 per hour in 1998.

Size

Average size has been increasing for all of the enterprise types, so that the total number of hogs sold or transferred from these farms is up 42 percent. Much of this increase was in contractee finishing with reduced per-unit labor requirements and returns, however. The combination of greater volumes but lower per-unit returns has left aggregate net returns for the group of farms about the same, as it would have been if volume had stayed at 1996 levels but was all produced in farrow-to-finish enterprises. The number of independent feeder pig finishing farms in the largest size categories (2,501-5000 and over 5,000 marketed per year) increased over the four years 1996-1999, while the numbers in the smaller size groups declined. The number of farms with wean-to-finish enterprises increased over the three-year period 1997-99 in all of the size categories for the wean-to-finish and contractee enterprises. For the farrow-to-finish enterprises, the number of farms increased only at the largest (over 1,000 litters) size even though the hourly returns were over $12 in the two smaller size groups.

Labor Efficiency

The difference in labor efficiency among the different swine enterprises is apparent. The labor requirement for the farrow-to-finish enterprises was more than twice as much as for finishing feeder pigs and for the wean-to-finish enterprises. This difference in labor is to be expected as the farrow-to-finish enterprises involve managing the sow herd, but the net returns have arguably not been adequate to compensate for the added labor. The added labor for wean-to-finish compared to finishing feeder pigs also makes sense in that wean-to-finish involves starting with younger animals.

The contractee enterprises appear markedly more labor efficient than the other enterprises, with less than half as much labor per pig compared to independent finishing of feeder pigs, although the largest feeder pig finishers were about as efficient as the contractees. Part of the reduction in contractee labor may be because the contractors provide management functions such as marketing, acquisition of feed and other inputs, and general supervision. Still, the contractee-contractor system of swine production is around twice as labor efficient as with the other enterprise types. The other side of this labor efficiency improvement of course is that the employment potential of the swine industry is declining.

Economies of Size

The presence of economies of size in pork production was evaluated by comparing the costs and returns across the size categories for the four major swine enterprises on the MinnesotaSCU-FBMA farms in 1996-99. The data was averaged across the four years in order to minimize the effects of year-to-year random variation and cycle effects, especially with regard to the unusual economic situation in late 1998 and early 1999.

The MinnesotaSCU-FBMA swine operations are probably similar to the overall Minnesota and north central U.S. swine industry, except that the "mega" operations marketing 500,000 or more per year are not represented and operations marketing less than 1,000 per year are under-represented. Economies of size were not evident in the farrow-to-finish enterprises, perhaps because of recent disease problems in the largest operations. Economies were much more apparent in the other enterprise types.

For the enterprises other than farrow-to-finish, minimum enterprise sizes required to achieve earnings of $10 per hour appear to be 2,500 hogs marketed per year for independent feeder pig finishing and wean-to-finish, 2,500 pig spaces for contractees (around 7,000 finished per year), or 200 litters for farrow-to-finish. In independent feeder pig finishing, the "over 5,000 marketed per year" group was twice as labor efficient at 0.11 hours per head as was the "2,501-5,000" size category, and as a result averaged $37 per hour over the four years 1996-1999.

Dairy

Competitiveness

Minnesota's share of the national milk market has declined from 8.3 percent in 1960 to 5.9 percent in 1998. Minnesota has dropped in ranking from third in 1960 to fifth in 1998. Nationally there has been a shift in where milk is produced. The greatest gains in market share have come in the western states. California has increased its market share by a factor of more than 2.5 since 1960 and is still growing. Pennsylvania, Michigan, and Vermont have tended to hold their market share, while the rest of the Northeast and Midwest has declined. States losing market share have been in the more traditional dairy areas - Wisconsin, Minnesota, Iowa, Illinois, Ohio, New York, Missouri, and Kentucky. These traditional areas tend to be made up of herds less homogenous in the way they are managed and operated with smaller herd sizes, and more diversified operations that grow a major portion of the feed supply that is marketed as milk.

The shifts in market share are at least partly explained by cost differences. The USDA regional production cost and return estimates for milk production for 1998 and 1999 show the Pacific region to be the low cost-of-production region. Total economic cost of producing milk in the Upper Midwest region, which includes Minnesota, was $0.45 per cwt. of milk above the national average in 1999. The major cost differences in the Upper Midwest region are feed costs that are $0.73 per cwt. lower than the national average, but higher capital costs, higher unpaid labor costs, and somewhat higher overhead, taxes and insurance. These estimates are limited in that they reflect averages for what they consider a single typical dairy for broad regions based on assumed average input costs and returns for the region.

Geographic Shifts in Milk Production Within Minnesota

Geographic shifts in milk production have also been occurring within the state. Minnesota's dairy belt has ranged from the southeastern counties of Houston and Fillmore, up through Winona, Goodhue, Wabasha, Rice, Carver, Wright, Stearns, Morrison, Todd, Ottertail and Becker Counties. The top five milk-producing counties are Stearns, Ottertail, Winona, Morrison, and Goodhue.

Over time, the exodus from dairying has been more pronounced outside of this region resulting in a greater geographic consolidation.

Number of Dairy Farms and Cows

Minnesota reached a peak of 151,064 dairy farms in 1945. More than 80 percent of the farms sold milk at that time. As of 1999, 11 percent sell milk. Dairy herd numbers were at 9,100 or 12 percent of the farms in 1999. Cow numbers have dropped from a high in 1945 of 1,660,000 to 540,000 in 2000. Dairy cow numbers declined by eighteen percent between 1993 and 2000, but the rate of decline appears to be slowing. The dairy cow density on agricultural land has sharply decreased from one cow for every 19 acres in 1945 to one cow per 54 acres in 1998.

Herd Size The structure of the Minnesota dairy industry has experienced dramatic changes in productivity, herd size growth, reduction in total cows and herds, and a dramatic reduction in the number of milk processing plants. Dairy farms are restructuring to larger, more specialized farms that are multi-person owned and operated, on a relatively smaller land base with greater vertical integration with the market and input sectors, and more diversity in size and production processes. Average herd size in Minnesota has increased from 11 to 58 cows per herd between 1945 and 1998. The number of small and medium herd size categories are decreasing most rapidly and the two largest herd size categories, above 200, cows are increasing in number in the 1990s. The average herd size nationally is 79 cows per herd. The number of dairy enterprises of less than 100 cows has been declining in Minnesota farm business summary programs. The enterprises in the 101-200 cow group and the 201-500 cow group increased over the four years 1996-1999.

Productivity

Productivity per cow has increased threefold between 1945 and 1998. Minnesota ranks sixteenth nationally in production per cow. Minnesota produces more than three times the amount of milk consumed in the state. Only about 15 to 18 percent of the total milk produced is consumed as fluid milk. The rest is processed into manufactured dairy products such as cheese, dry milk and butter and ice cream. In the 1970s and early 1980s, Minnesota was a national leader in butter, dry milk powder, and ice cream production. The industry has converted to cheese in response to changing consumer demands (Conlin 1995b), and almost 70 percent of Minnesota's milk was made into cheese in 1997.

Income

Milk sales are typically the largest generator of farm income in the state, ranging between 18 and 22 percent most years. Minnesota farm business summaries provide an indication of the degree of financial risk and economies of size in dairying and swine production over the four-year period 1996-99. For specialized dairy farms, the worst of the four years was 1997 when net farm income declined 25 percent from a year earlier, but net farm income averaged nearly the same over the four years as for the swine farms and was less variable. Nonfarm income has remained nearly constant on the dairy farms, in contrast to the sharp increase on the swine farms.

Returns
Dairy farm returns on assets and on equity were higher on average in the late 1990s than for swine, and the dairy farms ended with a lower debt-to-asset ratio and better liquidity (higher current ratio and term debt coverage ratio). Net return per cow was positive in all size groups, and did not increase with size beyond the 51-100 cow size. There is a marked improvement in labor efficiency as size increases. Net returns per hour varied from $11.21 for the smallest 1-50 cow size to $24.20 for the largest 201-500 cow size.

Alternative Grazing System
The most popular alternative dairy system in Minnesota is one that relies on grazing to varying degrees as opposed to conventional systems that rely totally or mainly on mechanically harvested feeds. The grazing dairies had smaller herd sizes, averaging 48 cows. The majority fell in the 1-50 cow group with a few in the range of 51 to 100 cows. The grazing dairies produced less milk per cow, but also incurred lower feed costs and total expenses per cow. The grazing dairies earned less per hour than the overall averages, however. The grazing dairies' net return per cow was less than the average for all sizes and slightly less than for conventional dairies in the 1-50 cow size.

Beef, Sheep and Poultry

There were 15,800 Minnesota operations with beef cows and 2,700 with sheep in 1999. Operations with cattle on feed numbered 7,400 as of 1998. Structural change in the Minnesota beef, sheep, and poultry sectors has been relatively minor compared to what is occurring in swine and dairy. Numbers of sheep and lambs are down by almost a third since 1993, although the January 2000 inventory has started to rebound with a 6 percent increase. Cattle on feed have also rebounded a bit over the past two years, which would be expected given the low feed prices. Beef cow numbers seem to be on a steady downward slide over the period.

Turkey production has grown since the early 1993, but appears to have leveled off in the past year at around 43 million birds raised annually. The number of laying hens is also up by 1.3 million. Nationally, contract broiler farms were in fair financial condition in 1995, with average net farm incomes of $15,969, which was less than half of the average $38,966 earned by other farms. While the broiler farms had lower incomes, they also had less invested in the business than did other farms, and worked fewer hours on the farm.

Forces Of Structural Change In the Minnesota Livestock Industry

Four over-riding forces that seem evident: 1) information technologies which increase the span of control of managers, making larger farms and other businesses feasible, and are also a major factor underlying globalization of finance and trade, 2) globalization, which presents new export opportunities for Minnesota farmers but also increases market volatility, 3) evolution of the food system into more tightly coordinated supply chains which challenge the historical leadership role and independence of farmers, and 4) negative public reactions to globalization and to how science and technology have been applied in the industrialization of agriculture, which may act as a counterweight that slows the industrialization of the food system, and at the same time may present market opportunities to astute producers who can tailor their production and marketing to the demands.

Driving forces differ among the dairy, hog/pork, beef, and poultry sectors. Dairy has historically been one of the more-protected agricultural sectors in many nations, so trade liberalization means that exports and imports could play an increasing role in domestic milk price movements. Food safety and quality concerns, constraints on western water supplies, and new on-farm technologies favor a shift toward a Midwestern dairy industry of larger operations that are have closer vertical ties to the rest of the supply chain. The pork industry has largely already made that transition. It may face the widest array of policy challenges of any of the species, with environmental, animal well-being, worker safety, and concentration and control all being areas of policy concern. The beef industry faces unique challenges due to its more segmented and dispersed structure. Continued attempts to improve efficiency by better coordination of the entire beef production chain are expected. The poultry industry is affected by many of the same forces affecting the other species, but export markets may be more important in the case of poultry.

Policies that can at least potentially affect livestock industry structure are many and varied. Those policy areas most often mentioned in that regard include environmental policy, industrial organization policies, international trade, commodity price supports, access to farm credit, land use and urban sprawl, intellectual property protection, subsidies for research and education, tax policy, economic development, transportation, immigration, and energy policies.

The first four policy issues (environmental policy, industrial organization policies, international trade, and commodity price supports) are discussed in some detail in the TWP because they interact in significant ways with technology, resources, and market conditions. The following paragraphs briefly summarize the most salient findings.

State-level environmental policies appear to be a factor affecting where livestock expansion occurs. There is anecdotal evidence that the perceived high cost of obtaining a feedlot permit, threats of legal action, and negative local attitudes have caused livestock producers to consider relocation to locations outside the Upper Midwest and Minnesota. However, it appears that most of the other major producing states are catching up with Minnesota in regulatory stringency. In addition, uniform federal regulations on the largest operations may lessen the importance of state differences in the future. Interestingly, standardized national standards could tend to push location decisions to the local level, where some communities are eager to embrace the industry while many others are not. Uniformity in environmental rules may also increase the importance of corporate farm and contracting legislation, unless proposed federal legislation is enacted in this area as well.

There are but few published empirical analyses of the cost of livestock operations' compliance with environmental regulations, and there is no comparison available on state-by-state variation in the overall costs of compliance with environmental regulation. One reason for the dearth of work on this area may be that the regulations are evolving so rapidly and vary so much across localities and farm types. Some information on the cost of environmental compliance is reported in the Role of Government chapter in response to Scoping Study Question 2.b.

Livestock production is modernizing around the world, so industry shifts across national boundaries could increase as a concern. The issue of livestock production moving across national borders is illustrated by the fact that in 2000 eight of the 50 largest swine operations in North America in 2000 were located in Canada.

Industrial organization policy has long been a concern of the livestock industry, particularly with respect to market concentration. Several recent studies have found little evidence that packers are using their market power, although with market concentrations as high as 80% the potential is acknowledged to exist and there are calls for continued antitrust vigilence. While surveys have shown that small sellers using the spot market generally received lower prices, the carcasses sold tended to have lower quality characteristics making it difficult to determine whether the small sellers were discriminated against or whether the price differences reflected justifiable quality and transaction cost differences. The empirical research tends to show that packer consolidation brings efficiency gains that largely offset the deleterious effects of increased market power. The spot market for hogs is shrinking and is expected to largely disappear in a couple more years, with a "market for contracts" taking its place.

Legislation has been proposed at the federal level and in 16 states to protect contract growers and producers, along similar lines to Minnesota's "Agricultural Contracts" law but with the addition of language to prevent retaliation against producers who participate in producer organizations.

In response to concerns about the marketing situation, the Secretary of Agriculture announced a new rule on November 28, 2000 that requires large cattle, swine and lamb packers and importers to provide information about livestock marketing, including pricing, for public dissemination. The new reporting will provide information on 80-95 percent of all cattle, boxed beef, slaughter hog, sheep, lamb meat, and imported lamb meat transactions including purchases for future delivery, and packer-owned livestock, subject to certain confidentiality guidelines.

While livestock producers tend to focus their concerns on consolidation and performance at the packer level, the academic literature suggests that developments at the retail level may dictate the future of the overall food industry. National supermarket chains could develop, and food manufacturers' brands could lose ground to those of the retailers.

International trade and trade policies are important to the Minnesota livestock industry. Export values of meat animals and livestock products have amounted to 14 to 17 percent of farm cash receipts in recent years. (Minnesota's shares of U.S. exports are shown in Tables 2 and 3 of chapter III of the TWP). Wheat is the most-exported of the major Minnesota crops, with 40 to 50 percent of the crop exported over the past five years. About a third of the soybean crop is exported as raw beans. Significant shares of the processed soybean oil and meal is also exported. Corn exports run about 20 percent of the crop. Poultry exports amount to around 17 percent of production, while 8 percent of red meat and 2 to 4 percent of eggs are exported. Exports of poultry and egg exports varied from eight to 12 percent, while dairy products were around 5 to 6 percent of farm cash receipts.

The idea of "putting a fence" around the U.S. (or Minnesota) and restricting supplies to raise prices will be more costly than in the past. Import competition from low-wage countries may contribute to income inequality in the U.S. general economy. The root cause is probably a technological one with no easy answer other than helping affected workers to adjust and providing "income safety net" programs for those who find such adjustments difficult. A "household income safety net" alternative to the current farm price support program seems appealing in that regard, but would entail a dramatic redistribution of program benefits. It is not likely to be enacted without an acrimonious political debate. The report of the 21st Century Commission on Production Agriculture suggests that the income safety net provisions of the 2002 farm bill are more likely to include a three-part income safety net including a fixed baseline payment, a counter-cyclical supplemental payment, and a continuation of the marketing assistance loan program.

Global warming is receiving increased attention. Carbon sequestration policies as a response to global warming could have dramatic impacts on Minnesota agriculture. On the other hand, global warming is expected to have both positive as well as negative impacts on crop production. One benefit of worldwide trade liberalization is that it would facilitate shifts in cropping patterns in response to global warming.

Motivations of Farmers to Expand or Quit

Study Question D.6 asks: "What motivates livestock producers and processors to start, continue, expand, and quit business? What are the characteristics of those starting, continuing, expanding, or quitting?" Little has been reported in the academic literature on these questions. To the extent that the GEIS work provides any answers, they come mostly from the interviews and panel discussions held by the teams researching the Social/Community, Land Use and Role of Government topics. Their findings are reported here.

The researchers report that the refrain "Get Big or Get Out" was heard time and time again to describe how current and former Minnesota farmers view their options in terms of animal agriculture. It is almost a now classic refrain passed on from generation to generation by farm families. For most of the twentieth century farmers have faced constraint on the choices they can make regarding their farming production system in both crop and animal production.

Confinement systems continue pressures to expand either by becoming more capital intensive or buying more land and more animals. The continued use of this refrain strongly suggests that the dualism to which they refer when pondering whether to “get big or get out” is not a by-product of current trends, but more likely endemic in the structure of American agriculture.

Swine and poultry producers were the ones to most often express this sentiment. It was less prevalent (but not absent) in the dairy and beef cattle sectors. One hog producer indicated that expansion is "all about dollars . . . If you don't have enough dollars to live, then you go find another income producing unit. Well, that is another hog. That means you have more hogs."

Producers overwhelmingly felt existing markets, government subsidies, and even government regulations are designed to benefit and encourage large-scale animal production over small-scale production. They often find they have to expand their operations to justify the investments they are required to make to be in compliance with Minnesota Pollution Control Agency (MPCA) regulations. This can foster a treadmill effect. In explaining how environmental regulations force small hog farmers to expand, one individual stated

> " . . .it's the only way for some of the small producers to be able to abide by some of the new regulations that were brought about and to be able to stay there . . . if you put enough animal units behind it, suddenly everything becomes feasible. But at 50 or 100 hogs, you can't afford some of the things you've asked them to do."

Vertical integration was often pointed to in personal contacts, as many respondents agreed "what happened in poultry will happen in pork", referring to the vertical integration of these sectors of animal agriculture. As one beef producer put it, “many farmers were very upset in that what they were seeing was the beginning of corporation farming and they see that as a threat to their own security.” The notion of farmers becoming the employees or even referred to as "slaves" of corporate-owned agriculture was a recurrent theme in our interviews with both small and large producers. The ownership arrangements of contract production (specifically in poultry and swine) were viewed by some as a precursor to increasing control and even ownership of farm-site production by national and international corporations.

Animal producers in the interviews who had moved into CAFO-based production reported the most increase in their quality of life. Most producers we spoke with felt their quality of life had either not changed or had improved in relation to changes in animal agriculture. Some farmers told us that by expanding their animal operations it helped create the financial means to bring their children into the farm operation. Many felt that without expanding or adding livestock they would not have made it in farming.

However, a number of large-scale confinement producers also talked about conflicts with neighbors and life-long friends as a difficult challenge.

A study of Minnesota dairy farms that significantly increased output in the early 1990's found that 80% of the increase came from increased herd sizes and the size increases were mainly accompanied by changes in the housing and milking facilities. The producers reported that the motivations for the increases were to: increase income, improve their lifestyle, improve the efficiency of the operation, and a desire for a management challenge.

A study of hog farmers quitting in Iowa in the mid-90's found that the average age of the farmers was 48, they had relatively little invested in their facilities, and the most common reasons for quitting were economic (poor returns or high costs). Half reported they had experienced health problems while raising hogs.

One reason for the initiation of many large hog confinement operations in the 90's may have been low grain prices which encourages former specialized grain farmers to enter the hog finishing business as a way to add value to their grains.

The TWP (page V-1-99) cites a number of studies on the motivations of packers and processors to seek greater vertical integration and contractual coordination linkages.

External Costs and Benefits of Animal Agriculture

This topic was identified in the *Scoping Document* as topic F. External costs and benefits, typically called "externalities" in economics, are impacts felt by people who are not party to a particular decision or transaction. For example, a farm has internalized costs (purchases of inputs) and when it sells its product there are internalized benefits (from the market transaction), but along the way there are external costs (e.g., effluent that is not paid for) and external benefits (contributing to an appreciated way of life). In economics, externalities are one of several "market failures," imperfections in the market that prevent "invisible hand" forces from leading to maximum welfare. Were it not for external costs and benefits the need for government intervention in the market would be dramatically reduced and much of the concern that led to this GEIS would not exist.

External costs and benefits can be divided into two general types: regional and community external costs and benefits (which can be positive or negative) and "spillover" costs that center on pollution but also cover other areas as well, and which are generally negative. Each of these types is treated in the two following sections.

Regional and Community Economic Impacts

A primer on regional economic impacts analysis principles and terms can be found in Appendices A & B of the Economics TWP.

This section focuses on those external costs and benefits concerning employment and income impacts to communities, regions, or states of livestock production and processing. The purpose is to see how regional and community economies are impacted by animal agriculture, exploring the following questions:

- What are the overall economic benefits of animal agriculture (from all sources, including spin-off economic activity?
- How do the benefits vary by type of production method, size, and location of operation and the animal population/ density in area?
- How are the economic benefits distributed locally (between owners, operators, employees, neighbors, and others) and in the state economy?

These questions were posed by scoping study questions F.1 and F.2.

The following twelve points summarize the major findings about regional and community external economic impacts of animal agriculture in Minnesota that were gleaned from the available studies by the TWP team. The reader can find detailed information on the various studies analyzed by the TWP team in drawing these conclusions in section V-2 of the TWP.

1) None of the studies found provide estimates of the net impacts of changes in the size of the livestock industry, after considering potential offsetting effects. In very tight labor markets, reductions in the livestock industry will release labor that will be used in other industries. If those industries contribute more to the state's gross state product than livestock, the net impacts would be positive rather than negative. While we doubt this would be the case, none of the current research provides insights on this question.

2) Nearly all of the studies found, although labeled "impact" studies, were descriptive studies that traced the economic linkages between livestock and other sectors. While these studies can show the economic importance of the sector, the data they provide cannot be used to estimate the net impacts of a change in the livestock industry.

3) Studies of the impacts of livestock or livestock processing that use a with/without approach, comparing changes between economic variables in a given community and in "twin" communities have to be very careful in selecting the twins. We found no studies that reported on the characteristics of the twins in sufficient detail that we could be confident that the livestock plants caused the changes noted.

4) The literature on whether small farmers buy more locally than large ones yields mixed results. An early study suggested that the percent of local purchases was lower for large farms but that the total amount was as high as for small farms. A

more recent study shows that generally the small farms do buy more within their county but buy almost all of their inputs within the state.

5) The local employment and income impacts of larger pork farmers are higher than small ones when the survival rate is considered. If it were possible to keep all small farms in operation over time, they would contribute more to the local economies. The quality of jobs, in terms of wages per worker, was higher for large pork farms whether or not survival is considered.

6) Meatpacking plants provide benefits to local farmers but the wages paid are considerably lower than the average manufacturing wage. These wages have fallen greatly over the past decade as the meat packing plants have moved from urban unionized plants to rural non-unionized plants. However, the studies that use a before/after approach to examine the impacts of these plants are not methodologically correct. Given the changes in the structure of the industry, the studies would have needed to use a carefully designed with/without approach.

7) Presumably the labor in the meat packing plants are better off than their next best alternative employment or they will not stay. Many workers do not stay with turn over rates being high. However, if the plants are able to find employees, the current ones must be better off than they would be in their next best alternative. The impacts on the social aspects of the community are less clear but beyond this part of the report.

8) Meatpacking and poultry processing is moving to fewer big plants in remote rural areas. This reduces the odds that communities can use this as a development strategy. However, if the community is remote enough and other alternative jobs are scarce these plants can have a positive impact.

9) Wages appear to be competitive in the livestock production, after controlling for skills and regional differences. However, the research base for this conclusion is very thin.

10) The public sector fiscal impacts of livestock operations appear to be positive. Again, the research base for this is very preliminary and needs much greater attention. Further, this research does not tell us what would happen if the size of the livestock sector changed in a community or region.

11) Research on the impacts of farm size on poverty has used either the comparable area approach or a variation using multiple regression analysis. The most comprehensive study found rural poverty rates were influenced most by social relations and economic structure of the region and least by the size of farms.

12) In order to evaluate the trade-off between economic benefits and environmental or social costs of livestock production, changes have to be studied at the community or regional level. Studies done in other regions cannot be extrapolated onto a local

economy since the regions are likely to have different economic structures. Consequently, the same type and size of livestock operation will have very different impacts in different types of local economies. Similar differences are probably true on the environmental side. The value of this generic study is in guiding future research rather than in guiding public policy.

The reader, like most of the participants in the GEIS study, is likely to be disappointed by the little conclusive information on the external benefits of animal agriculture to communities. Since the current research does not provide much evidence of the potential economic and fiscal impacts of new feedlots on communities or counties, the Economics TWP includes an extensive discussion of recommendations for future research. To estimate the overall economic benefits of animal agriculture, either regional input-output or integrated econometric/regional input-output are the most accurate and practical. However, the input-output and integrated econometric/input-output models will give accurate results only when the data used is accurate and when the impact scenarios are properly defined to include both the impacts on the livestock industry and any potential offsetting effects.

The research listed below is necessary if clear conclusions are to be reached. The Economics TWP (page V-2-32) provides greater detail on the recommendations.

1) estimation of the regional purchase coefficients in order to accurately estimate the purchases within a region;

2) examination and verification of the fiscal impact models components of integrated econometric/input-output models;

3) integration of the social impacts work with the fiscal impact analyses;

4) examination of the regional production functions in input-output models;

5) studying the potential off-setting effects and means of accurately defining the impact scenarios;

6) greater collaboration between economists, sociologists, anthropologists, ecologists, and production agriculture scientists in studying the economic, social and environmental impacts of different types of agriculture;

7) practice in using integrated econometric/input-output models in local settings for educational purposes;

8) determination of alternative regional scales;

9) incorporation of a temporal dimension to the economic impact estimates;

10) examination of the overall structure of agricultural production in terms of the local economic impacts.

Spillover Costs

This topic of the GEIS (specifically Scoping Study Questions F.3 and F.4) deals with *how to quantify* -- that is, attach dollar values to -- the various negative environmental and social impacts of animal agriculture as addressed in the other chapters. Quantification is desirable because although just about any policy or practice will result in externalities, the question remains, *how big are they?* Are they worth worrying about? In addition, how do the external costs compare to the estimated external benefits of the policy or practice? The Scoping Document called (Study Question F.3) for estimating the overall economic costs of animal agriculture on the following: tourism and recreational businesses; public roads and other costs to government; pollution of air, water and soil; and property values and tax base. It also hoped (Study Question F.4) to answer how these costs varied by production system factors and how the costs were distributed among various groups in society.

Unfortunately, the literature contains very few cases where previous analysis has followed the entire path from a particular practice to a physical impact to human values and a dollar cost. While the existing research provides a good start for many estimates that would be useful for the GEIS, new secondary research is needed to fill the gaps. The tools exist to map particular policies or practices in animal agriculture to the value of the resulting externalities, and the possibility is generally acknowledged in several related literatures, however, the actual mapping that would be of immediate use in the GEIS process has only been done a few times for a few specifics. Due to the limited resources available to complete this GEIS, the EQB was unable to commission research to try to fill in any gaps. Therefore, very little information on spillover costs can be reported in the GEIS, and the two referenced study questions must go unanswered at this time.

One specific disappointment is that there seems to be almost no economic information on the "Main Street" issue, the question of how much loss people suffer as a result of the disappearance of the traditional rural and small-town lifestyles that results from consolidation in the animal agriculture industry. Another is that the question of whether concentration of production makes particular externalities worse, better, or neither remains open and controversial.

While we are not able to present much information on the external costs as called for in scoping, we do note that policy and popular discussion of agriculture seems increasingly devoted to externalities (though typically not using that term). Furthermore, externalities from animal agriculture are increasingly recognized as a subsidy granted to the industry (an uncompensated transfer of society's wealth in the form of environmental goods and social capital), even though they are seldom quantified and although policy use of externality-based analysis remains very limited. Given the broad collection of externalities associated with animal agriculture, the socially optimal level of production and consumption is probably much lower than the free-market level. Therefore, if restrictions are imposed on farming operations that raise costs and prices, it may be that those higher prices are actually beneficial in that they would move us toward the social optimum. Policy makers do not seem to have yet considered that production that is more efficient in the colloquial sense (measured from a business accounting perspective) may be less efficient in the economic sense (it produces lower total social welfare).

Recommendations for Economics research

All the CAC consensus recommendations relating to Economics are found in Appendix D, near the end of this document. A number of technical recommendations from the University of Minnesota staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. While there is extensive economic data on the livestock industry, much of the Economics paper focused on how difficult it was to answer the questions posed by the CAC with the existing data. Additional research is needed to address gaps in the current knowledge of potential overall economic impacts of animal agriculture in Minnesota. It is particularly important to document and quantify the externalities associated with animal agriculture. The hidden social and environmental costs must be more completely determined in order to make informed decisions about the real costs and benefits of animal agriculture.

Appendix 1. The Organizational/ Financial Structure of the Agribusiness Firm: The Choices and Options

Legal Organization	Business Arrangement	Leasing Options	Equity	Debt
▪ Sole Proprietorship ▪ Partnership - General - Limited ▪ Corporation - Regular - Subchapter S ▪ Limited Liability Company ▪ Land Trust ▪ Cooperative	▪ Independent Producer ▪ Contract Producer ▪ Subcontractor ▪ Joint Venture ▪ Strategic Alliance ▪ Franchise Agreement ▪ Licensing	▪ Real Estate Lease - Cash lease - Share lease - Flexible cash lease - Shared appreciation lease ▪ Facility/ Equipment Operating Lease ▪ Capital/ Financial Lease ▪ Leveraged Lease ▪ Leasebacks	▪ Sources - Initial capital contributions - Retained earnings - Stock * Common stock * Preferred stock - "External" equity - Warrants or options - Venture capital ▪ Business Practices - Payout (dividend or withdrawal) policy - Intrafamily transfers - ESOPs and stock options - "Buyout" policies	▪ Loans - Maturity - Interest rate - Amortization arrangement - Prepayment features - Security/ collateral - Conversion of terms - Shared appreciation mortgages - Reverse mortgages - Interest rate strips, futures, options, swaps ▪ Bonds - Convertible bonds - Callable bonds - "Zero coupon" or deep discount bonds

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Water Quality

The material in this chapter is based on the 2001 Technical Work Paper (TWP) on Water Quality for the GEIS and the Water Resources Chapter G of the 1999 Literature Summary. The Literature Summary chapter presents an extensive discussion of the impacts of animal agriculture on surface and ground waters. The TWP provides data, maps and information on a number of key issues, such as land application of manure and commercial fertilizers. Readers are directed to explore these resources for detailed information on water quality.

The format of this chapter is based on the Study Questions in the Scoping Document that addressed pollution impacts and risks to surface and ground waters from current Minnesota animal agriculture systems compared to other sources of water pollution. The Water Quality TWP discusses water quality pollution minimization and mitigation measures. The agricultural convention of using N for the element Nitrogen and P for the element Phosphorus will be followed throughout this document..

Scoping Question 1: To what extent are groundwater and surface water affected by or at risk from animal manure storage, handling, and application?

Surface water

Livestock waste that contains nutrients, sediment, pathogens, and hormones can severely degrade surface water quality. Nutrients are often carried in runoff from manured fields to surface waters; nutrient losses in runoff increase with the rate of manure applied. Nutrient losses are least when manure is applied in late spring and greatest when manure is applied in fall; they are excessive if manure is applied to frozen soil or snow. Nutrient losses also increase when the time between land application and rainfall is brief. P is the primary nutrient lost in surface runoff: livestock waste can contribute significantly to P loads in surface waters (7-65 percent of total load), and less significantly to N loads (15-37 percent of total load). Critical areas for P loss to surface waters are typically those soil areas high in P in close proximity to water bodies; however, P loss can be negligible if erosion and runoff are controlled in the field.

Large areas of Minnesota are poorly drained and have artificial tile drainage installed to improve soil productivity. Drainage lines can carry manure constituents from the field into surface water. Farmers must have these drainage systems to manage crop nutrients and produce crops on their land. The positive economic benefits of agricultural land drainage in Minnesota have been significant. The potential negative effects are poorly documented and should be the subject of future research. The major factors that influence nutrient loss through tile drains include rate of manure application, timing of application, form and method of application, tillage and cropping system. The original literature review on nutrient losses through tile drains showed that, unlike surface runoff, the most significant contaminant in subsurface tile drain effluent is nitrates. There is no substantial peer-reviewed journal research available on the impact of surface tile inlets on nutrient losses from land application of manure.

Soluble and total P losses are generally negligible in comparison to their losses in surface runoff, unless very high rates of manure are applied, or the soil test P levels have risen to excessive levels. Nitrate losses in subsurface tile drainage increase with the rate of manure or fertilizer applied, unless very high rates of manure are applied on wet soil, when denitrification reduces the losses of N. Liquid manure applications cause more risk for nitrate leaching to tile drains than surface applications of solid manure, especially when liquid manure is injected.

Surface water impairment from pathogens is a great problem in most rural areas of southern Minnesota, causing many rivers and lakes to be unsuitable for swimming. Lands receiving fresh manure applications can contribute a significant proportion (over 80 percent) of the fecal bacteria carried in surface waters. Rate or timing (spring vs. fall) of manure application has little effect on fecal bacteria counts in surface runoff, although they are significantly greater after application of manure to snow or frozen soil. Storing and aging manure before land application can result in pathogen runoff concentrations not significantly different from those from unmanured lands.

Impacts of runoff, spills and land application of manure on water

Catastrophic spills from large manure storage facilities can occur from overflow following large storms, through mismanagement, by intentional releases, or less frequently, by collapse of a sidewall (which has never occurred in Minnesota). The impacts on surface water quality and aquatic life from these spills, feedlot runoff and land application of manure to frozen ground can be devastating. The number of documented serious water quality pollution problems involving these events is generally several times per year in each state with high concentrations of feedlots. However, this number is typically a small fraction of the total number of operations.

Most people, as well as the popular press, do not focus their attention on land application of manure, but on manure losses to surface water from runoff, seepage and spills. There is no question that these events can have disastrous consequences, including fish kills, with the delivery of oxygen demanding substances and toxic concentrations of ammonium. In the context of regional water quality, however, how significant are these catastrophic events?

First, consider manure spills. According to newspaper reports in Minnesota, roughly 20 spills occur per year. Most are from hog feedlots, with a few from dairy feedlots. Assuming that each of these spills discharges 50,000 gallons, one hog manure spill of this magnitude would discharge 1.5 tons of N and 1 ton of P while one dairy manure spill would discharge 1 ton of N and 0.4 tons of P. Together, twenty such spills (18 from hogs and 2 from dairy) would discharge 29 tons of N and 20 tons of P. In comparison to the 55,423 tons of nitrate-N per year and 1,492 tons P per year carried by the Minnesota River, the quantities of nutrients discharged to surface waters from manure spills are negligible.

Second, consider runoff and seepage from feedlots that do not comply with Minnesota Feedlot Rules. 15 percent of feedlots in the 18 counties studied are estimated to be noncompliant. Based on the proportions of animal species and size classes, the amount of N and P produced from all non-compliant feedlots can be estimated as 265 tons of N and 573 tons of P. In comparison with the 27,753 tons of N and 62,077 tons of P applied to cropland from manure, the noncompliant feedlots represent a negligible amount of regional risk to water quality.

As can be seen from these analyses, the impacts of land-applied manure are the dominant water quality concern at the regional scale. Spills, runoff or seepage can, however, have disastrous water quality consequences at the local scale.

Ground water

Animal agriculture can seriously affect ground water. Many factors influence contamination of ground water, including depth and condition of wells, type of soil and geologic material above aquifers, location of well, land use surrounding well (particularly cropland), density of animals and manure handling and application practices, and type of lining on manure storage systems. Ground water contamination from animal agriculture is most likely to occur in regions having coarse textured soils, shallow ground water and heavy precipitation.

Seepage of Nutrients from Manure Storage.

Lined manure storage basins and lagoons that are properly constructed, engineered and managed are generally not a serious threat to ground water quality, unless constructed in coarse textured soils or karst terrain. Unlined earthen manure storage systems generally pose a much greater risk for pollution of ground water by seepage than lined storage facilities.

The Minnesota Pollution Control Agency recently summarized four ground water monitoring studies in Minnesota between 1994 and 2000. Much of the monitoring was conducted on coarse textured soils, and so represents worst-case scenarios for seepage. The first study sampled ground water adjacent to manure systems older than five years, looking at three or four sites for each of the following: open feedlots, feedlots with unlined manure basins, feedlots with earthen-lined basins, and feedlots with concrete-lined basins. Contamination plume lengths exceeded several hundred feet down gradient of unlined manure basins. These ranged from 200 to 400 feet down gradient of earthen-lined basins and open lots, and were 100 feet or less down gradient of concrete-lined systems.

Most plumes had high concentrations of ammonia, organic N, organic carbon, P, chloride, and potassium. The study found maximum concentrations of ammonia of 265 milligrams per liter for unlined basins, 66 milligrams per liter for earthen basins, 36 milligrams per liter for open lots, and 4 milligrams per liter for concrete basins. Maximum P concentrations were 36 milligrams per liter for unlined systems, 13 milligrams per liter for concrete- and earthen-lined systems, and less than 1 milligram per liter for open lots.

The second study of ground water beneath three earthen-lined manure basins indicated high concentrations of chloride and high specific conductance in leachate, with highest concentrations occurring in sidewalls.

The third study of ground water beneath an earthen-lined basin with a 0.1 mm-thick polypropylene liner found that N concentrations in ground water beneath the feedlot had decreased by 55 percent in the three years since construction. Concentrations of P and organic carbon had also decreased.

The fourth study of ground water adjacent to 13 newly constructed earthen-lined basins (built between 1994 and 1997) proved inconclusive. While upward trends in the concentration of one or more chemicals associated with liquid manure were observed at seven sites, no trend or a decreasing trend was observed at six sites.

These studies show that liquid manure storage basins vary in their risk of seepage, and that seepage rate decreased in the order: unlined earthen basins (most seepage) > open lots > lined earthen basins > concrete pits (least seepage).

Infiltration of Pathogens and Hormones.
Little information is available on contamination of ground water by pathogens or hormones. However, one recent article explored the movement of 17ß-estradiol (E_2), fecal coliform and *Escherichia coli* through the hydrologic system in a region karst limestone geology. The authors concluded that animal waste contributes E. Coli and fecal coliform bacteria to ground water in karst areas with a high density of livestock operations.

Scoping Question 2: How do the effects or risks (from scoping question #1) affect the use of water by humans for drinking, recreation, and other purposes?

Drinking water can be contaminated by pathogens and nitrates arising from animal agriculture. However, it is often difficult to separate animal agriculture's contribution from among the potential sources of contamination, which also include septic systems and human sewage. In terms of pathogens, it is estimated that up to 900,000 illnesses and 900 deaths occur each year in Minnesota from waterborne microbial infections, but the source of contamination in these instances is not known. In terms of nitrates, roughly 7 percent of the 450,000 private drinking water wells and 1 percent of the 1,700 public community water supply wells in Minnesota have nitrate-N levels exceeding the maximum contaminant level (MCL) of 10 milligrams per liter, but the percent affected by animal agriculture is unknown.

Nationally, it is estimated that 36 percent of rivers and streams and 39 percent of lakes are impaired, meaning they do not meet the standards set forth in the Clean Water Act and state regulations. The primary cause of impairment in 70 percent of these rivers and streams was agriculture, including nonirrigated cropland production (36 percent), irrigated cropland production (22 percent), rangeland (12 percent), and pastureland

(11 percent), feedlots (8 percent), animal operations (7 percent), and animal holding areas (5 percent). In Minnesota, about 60 percent of surveyed or monitored rivers and streams, and 17 percent of surveyed or monitored lakes were classified as impaired. Agriculture was identified as the cause of 90 percent of impaired river miles, and 64 percent of impaired lake acres. It is unknown to what degree various types of agricultural activities (cropland, feedlots, rangeland, etc.) caused the impairment. In the Minnesota River basin, none of the tributaries is fit for swimming, primarily because of high levels of fecal bacteria. Due to high costs and limited resources in Minnesota, between 1 and 10 percent of the lakes or river and stream miles have periodic monitoring for a small set of chemical parameters. Ground water monitoring data is also limited in scope and extent.

Scoping Question 3: How do the effects or risks (from scoping question #1) affect fish and wildlife (such as fish kills due to pollution)?

Fish are known to be quite susceptible to the impacts of poor management in animal agriculture -- a few serious incidents of feedlot runoff, manure spills and runoff from manure on frozen ground can lead to the death of thousands of fish. It is widely believed that many fish kills are undocumented, and there is no comprehensive record keeping mechanism for tracking the number or magnitude of fish kills. Scientists have recently found that amphibians can be affected by nitrates at relatively low levels and that many watersheds in the Great Lakes area have nitrate levels high enough to cause severe developmental abnormalities and death in amphibians.

Scoping Question 4: What are the health risks to humans from contamination of ground and surface waters from animal manure storage, handling and application?

Two types of risks in drinking water are related to animal agriculture: excessive nitrate levels and pathogens. Nitrate is a common contaminant found in many wells in Minnesota. It has been known since the mid-1940s that too much nitrate in drinking water can cause serious health problems for infants. Roughly 7 percent of drinking water wells in Minnesota exceed the Maximum Contaminant Level set by EPA for nitrates in drinking water. Drinking water contamination can occur from N in fertilizer, septic tank seepage and animal manure.

Fresh animal manure contains a variety of microorganisms that may be pathogenic to humans. The major types of pathogens include bacteria, viruses, parasite eggs, protozoa and fungi. The potential of disease transmission from land application of animal manure depends upon: the number and viability of microbial pathogens in manure, which in turn depends upon the type of treatment it has received; the survival of pathogens for a sufficient period of time and in sufficient numbers; and the entry of these pathogens into waters and their subsequent ingestion through the mouth as a result of drinking or swimming.

The U.S. Centers for Disease Control recently summarized waterborne disease outbreaks attributed to pathogens in 1997 and 1998. Thirteen states reported 17 outbreaks associated with drinking water, causing 2,038 persons to become ill. Various sources of contamination were identified, including beavers, rodents, raw human sewage, wildlife, chemicals, and pastured cattle (affecting three people in Illinois). Thirty-two outbreaks from 18 states were linked to recreational water, affecting 2,128 persons. Very few of the reported outbreaks during 1997 and 1998 were directly linked to animal agriculture.

Scoping Question 5: To what extent are surface waters affected by or at risk from allowing pastured animals (primarily cattle) access to surface waters?

Unmanaged grazing has many negative impacts on streams and their nearby landscapes. Heavy grazing reduces vegetative cover, compacts the soil, reduces infiltration and increases runoff, erosion and nutrient and sediment yield. In riparian zones, heavy livestock traffic on stream banks decreases erosional resistance of the stream bank and contributes to sediment yield, while vegetation removal increases solar insolation and leads to higher stream water temperature. Excrement deposited either in the uplands or directly into water bodies can lead to elevated levels of nutrients and pathogens. Fish and aquatic invertebrates are sensitive to sediment input, water temperature and excess algae and plant growth due to nutrient input. In contrast, low or moderate grazing effects are much less significant than heavy or unmanaged grazing. There is some evidence that low and moderate levels of well-managed grazing can improve riparian habitat.

Scoping Question 6: How do the various impacts in Scoping questions #1 to #5 vary by species, operation, system type, management, geography, geology, watershed characteristics, and concentration of livestock facilities?

Geology and geography.

Minnesota has a wide range of characteristics in soil and geologic sediment properties, hydrogeology and climate, and patterns in runoff and erosion which strongly influence the potential for pollution of surface and ground waters by animal agriculture. Statewide patterns in river and lake water quality vary dramatically among the major basins and ecoregions in Minnesota. Patterns in degradation of ground water quality vary primarily in response to differences in land use, soil and sediment properties.

The four geographic regions studied have distinctly different water quality patterns, and are in different river basins. Long-term water quality monitoring for total P concentrations is available for most of these regions. South central Minnesota is primarily in the Minnesota River basin (16,200 square miles drainage area), a river which generates large loads of N and P (59,180 tons N per year and 1,488 tons P per year, respectively.) Central Minnesota is primarily in the Upper Mississippi River basin (19,100 square miles drainage area), which generates moderate loads of N and P (21,059 tons N per year and 1,088 tons P per year).

During moderate flow years, roughly 90 percent of the N loads and two-thirds of the P loads in these two basins are from non-point sources, including cultivated and fertilized cropland, and animal agriculture operations.

Southeastern Minnesota is primarily in the Lower Mississippi River basin. As a whole the N and P loads (in contrast to the N and P concentrations) from this region are less well monitored than the loads for the Minnesota and Upper Mississippi river basins. The loads of N and P from this region, however, are probably very similar to those of the Chippewa River at Durand, Wisconsin, just prior to its discharge into the Lower Mississippi River. (The Chippewa River has N and P loads of 10,318 tons per year and 811 tons per year, respectively, and drains 8,999 square miles). The surface water quality loads of N and P (not concentrations) of watersheds draining to the Missouri and Des Moines River basins in southwestern Minnesota are also very poorly known. Based on available information, we estimate that the extent of surface water degradation (based on loads of N and P carried per unit area) in the four regions studied decreases in the following order:

Southern MINNESOTA > > Southeastern MINNESOTA >
> Central MINNESOTA > Southwestern MINNESOTA

Ground water pollution patterns also are distinctly different in each of the four regions. The worst ground water nitrate levels occur in southwestern Minnesota, where more than 40 percent of the wells in some watersheds exceed 3 milligrams per liter nitrate. These are partially a result of the numerous shallow, hand-dug wells located in shallow alluvial material.

Another region with serious ground water pollution is on alluvial and coarse textured outwash soils in central Minnesota. Greater than 13 percent of the wells have nitrate levels exceeding 3 milligrams per liter in a large percentage of Morrison, Stearns and Todd counties. Ground water pollution by nitrate also occurs in the karst geology region of southeastern Minnesota. In some watersheds, greater than 40 percent of wells have nitrate levels exceeding 3 milligrams per liter. Ground water pollution by nitrate is much less frequent in southern Minnesota, occurring primarily along the Minnesota River. Thus, the extent of ground water degradation in the four regions studied decreases in the following order:

Southwestern MINNESOTA > Central MINNESOTA >
> Southeastern MINNESOTA > Southern MINNESOTA

Species type, system type and operation size.

Manure storage techniques are used for either liquid or solid manure. Liquid manure storage types include poured concrete tanks, concrete block/stave pits, earthen holding basins, and aboveground tanks. The risk of polluting surface or ground waters by liquid storage techniques decreases in the order:

Earthen holding basins > concrete blocks > poured concrete tanks > above ground tanks.

Solid manure storage types include solid stacking slabs, daily hauling (no storage), stockpiling (no structure), and manure pack in buildings. The risk of polluting surface waters by solid manure storage techniques decreases in this order:

daily hauling > stockpiling > solid stacking slabs > manure pack in buildings. Manure storage systems greatly influence the risk of N and P being delivered to surface and ground waters. Environmental risk to surface and ground water is greatly reduced when manure is stored under a roof, or on concrete pads, where surface and roof water inflow are diverted from the storage system. Liquid manure storage results in little environmental risk to surface water except when earthen basins without liners are constructed on coarse-textured, sandy soils. Above- and below-ground poured concrete tanks pose little environmental risk to surface and ground waters. Earthen storage basins with a clay or synthetic liner constructed on fine-textured, clay soils also pose little risk. The risk for N movement to the ground water increases if the basins are constructed on sandy soils, or without a liner. Earthen storage basins constructed in landscapes over karst (fractured limestone and sandstone) pose a moderate risk of N and P losses to both surface and ground water due to the potential for leaching of N and sink hole development under basins.

A large diversity of manure storage techniques actually in use for animal operations in Minnesota. Beef feedlot storage types are primarily manure pack in buildings (51 percent of all beef feedlots) for solid manure, and earthen holding basins (16 percent) or poured concrete tanks (11 percent) for liquid manure.

Environmentally riskier types of solid manure storage include daily hauling (5 percent) and stockpiling with no structures (7 percent). Daily hauling occurs primarily with small beef feedlots, where it accounts for 12 percent of the storage types. Other size classes of feedlots have a much smaller incidence of daily hauling. Stockpiling with no structures occurs primarily in the very small feedlot operations, where it accounts for 13 percent of the storage types. As size of the feedlot operation increases, the incidence of stockpiling decreases. Earthen holding basins tend to be more common with larger beef feedlots.

Dairy feedlot storage facilities for liquid manure are primarily earthen holding basins (39 percent of all storage types for dairy feedlots) and poured concrete tanks (13 percent). For solid manure, dairy feedlots typically have no storage (daily haul operations represent 23 percent of storage types) or use manure packs in buildings (11 percent). Daily hauling decreases in frequency as the size of dairy feedlots increases and use of earthen holding basins increases in frequency as feedlot size increases.

Hog feedlots primarily use poured concrete tanks (61 percent) and earthen holding basins (11 percent) for manure storage. Concrete tanks increase in frequency as feedlot size increases with 85 percent of the large hog feedlots using them. The frequency of earthen holding basins also increases with feedlot size.

One third of chicken feedlots store manure packs in buildings, while 28 percent use poured concrete tanks, and 10 percent use earthen holding basins. Poured concrete tanks,

above ground tanks, and daily hauling operations all increase in frequency as the size of chicken feedlots increases. Moderate sized chicken feedlots have the most diverse storage types, with manure packs occurring in 41 percent of the facilities.
Turkey feedlots are dominated by storage of manure packs in buildings (84 percent of the feedlots), with another 11 percent of turkey feedlots using stockpiling with no protective structure.

Based on the information presented on manure storage systems only, and assuming all other factors are equal, the risk of surface water pollution from feedlots decreases in this order:

Dairy > beef > hogs > chickens > turkeys

The risk for polluting surface water tends to be greatest from solid manure (based only on storage type) from smaller feedlots rather than larger feedlots. Smaller feedlots tend to have a greater likelihood of having daily haul or stockpiling without protective cover. The risk for polluting ground water tends to be greatest from liquid manure (based only on storage type) from larger feedlots rather than smaller feedlots. Larger feedlots tend to use earthen storage basins for liquid manure more than smaller feedlots.

Manure application methods.

Animal manure may be applied to land by broadcasting (surface spreading of solid manure), broadcasting with incorporation (surface spreading of solid manure followed by immediate plowing under of surface material), subsurface injection (where liquid manure with or without additional water is placed about 4 to six inches below the surface with special equipment), or irrigation (where liquid manure with or without additional water is placed on the surface and allowed to infiltrate into the surface soil). In general, injection or incorporation of manure leads to smaller risks for polluting surface water than for all other methods. The site-specific risks to water quality from any of these operations also depends on the amount applied, the nutrient content of the manure, the time of spreading before any rainstorms or snowmelt, the slope of the landscape, the proximity of the land to water bodies or tile intakes, the depth to ground water, conservation practices used, the type of soil, the amount of residual nutrients in the soil, the type of crop and crop yields, and the manure application history.

Assuming all other factors (such as rate of application and numbers of feedlots) are equal, the risk of polluting surface water from land-applied manure typically decreases in this order:

Daily haul > Non-daily haul broadcasting > broadcasting + incorporation > injection

Most animal manure in Minnesota is broadcast on the land. Injection of manure tends to be more common with hog operations where odor concerns are often greater. It was estimated that manure is broadcast and incorporated, or injected in 35 percent of hog operations, 11 to 15 percent of dairy or beef operations, and 7 to 9 percent of poultry operations.

Injection and incorporation of manure both tend to increase in frequency as the size class of hog feedlots increases. Winter applications of hog manure are most likely from daily haul operations, which represent only 6 percent of hog feedlots. Injection and incorporation of manure also tends to increase in frequency with the size of beef and dairy feedlots. The riskiest time of application in these operations is winter spreading. Twenty- three percent of dairy feedlots have no storage and use daily hauls, including broadcast application of manure to frozen or snow covered soil during winter. This practice has a high potential for polluting surface waters.

In summary, as the size of an animal feedlot increases, the application methods tend to shift from broadcasting to injection or to broadcasting with incorporation. This trend is more pronounced for hog feedlots than for beef and dairy feedlots. Poultry feedlots rarely use injection or incorporation of manure, rather relying on spreading.

FANMAP

The MDA conducted FANMAP surveys in 1998 of selected feedlots in several regions of Minnesota. These surveys included questions on rate and method of application, timing of application, and type of crop receiving manure. Survey results showed that manured lands often can receive rates of N and P that are in excess of nutrient guidelines developed by the University of Minnesota. Farmers may regard excess manure nutrients as inexpensive crop insurance and a low cost method of manure disposal. Excess nutrients applied to land increases the risk of surface and ground water pollution.

As part of an MPCA feedlot permit application, owners must specify the total acres of cropland available for manure application. Knowledge of the land affected by manure application is crucial information that determines rates of recommended manure nutrients applied to land. For feedlots with equal numbers of animals and similar management practices but less land for manure spreading will have to apply higher rates, resulting in potential application of excess nutrients to the land. Only a small percentage of these acres are typically used for manure application in any year, according to FANMAP surveys, in the range of 30 percent for corn and 5 percent for soybean, wheat or alfalfa acres.

Concentration.

As size of animal operations increases, the nutrients lost to the environment also increase, and as the density of animals in a watershed increases, the impact on surface water quality increases. The critical threshold density depends upon the type of animal, the region and its characteristics, and waste storage, handling and application methods.

For each species, the TWP conducted linear regression between the total acres of cropland available for spreading and the number of animal units for each animal species. Except for turkeys, the land available for application of manure increased linearly with the size of feedlots. Using the regression lines relating animal units to acres of land available for manuring, calculations can be made by the amount of land typically available for manure application for feedlots of different sizes. The typical density of animals per acre of land available for manure application can then be calculated. Such calculations demonstrate that the typical availability of land for manure application varies by animal species. Average land available for manuring (in acres per animal unit) on 500 animal unit. feedlots decreases in this order:

turkeys (1.5 ac/AU) > dairy (1.1) > hogs (0.92) = beef (0.91) > chickens (0.82)

Alternatively, if animal units are converted to animal numbers, the average density of animals per acre of manured land for 500 animal unit feedlots is:

Chickens (122 animals per acre) > turkeys (38) > hogs (2.7) > beef (1.1) > dairy (0.65)

Note how the order of species is changed due to the large difference in the numbers of animal units per animal among species.

The data is also plotted in another fashion in the water quality TWP Figures 7a-e, which shows the percent of feedlots of each species in Minnesota likely to exceed a certain density of animal per acre of land available for manure application. These graphs show that the average (50 percent exceedance probability) densities per species are:

Chickens (110 per acre) > Turkeys (50) > Hogs (1.1) > Beef (0.3) > Dairy(0.4)

The water quality TWP Figures 8a-e present the average animal unit density by minor watershed for each of the 18 counties studied.

Are these densities too high anywhere? By what standard can this be judged? The TWP analysis compares the calculated densities with standards for animal densities that have been adopted in Europe, since no U.S. standards have been developed. The European livestock methods differ from Minnesota's thus, the European standards used in the water quality TWP should be considered as just a ballpark indicator in determining whether any of our animal densities may be undesirably high.

The European density standards in animals per acres:

Chickens - 53.8	Beef - 1.6
Turkeys - 40.5	Dairy - 0.8
Hogs - 6.5	

Comparing these numbers to the average densities calculated for Minnesota shows that Minnesota's chicken and turkey averages are higher (although the Minnesota density number for turkeys is less certain due to longer distance hauling of manure) while hogs, beef and dairy are lower than European density standards.

Maps made from this data (Figure 8 of the water quality TWP) show:

- Chickens (Fig. 8a) - animal densities in over three-fourths of the watersheds with chickens exceed the density (53.8 chickens per acre) established in Europe. Chicken feedlots in Stearns, Todd and Morrison counties are rarely below this threshold density.

- Turkeys (Fig. 8b) - about half of the watersheds with turkeys exceed the threshold density (40.5 turkeys per acre) established in Europe. Turkey densities are subject to uncertainty based on the variability in the area of land available for spreading of manure from each turkey feedlot.

- Hogs (Fig. 8c) - less than one-fourth of the watersheds with hogs have hog densities greater than the critical threshold value (6.5 hogs per acre) established in Europe.

- Watersheds with the densest concentration of hog feedlots are located in Blue Earth, Watonwan, Martin, Freeborn, Rock and Pipestone counties.

- Beef (Fig. 8d) do not generally exceed the European threshold density of 1.6 beef cattle per acre in any of the watersheds evaluated.

- Dairy cattle (Fig. 8e) do not generally exceed the European threshold density of 0.8 dairy cattle per acre in any of the watersheds evaluated.

Scoping Question 7: What are the current and potentially available best management practices and mitigation technologies to prevent against ground and surface water pollution from manure storage, handling, and application and to what extent are they effective?

This question is essentially the same as Scoping Question 5 under Topic J, Manure and Crop Nutrients. The reader is directed to the chapter on Soils and Manure section of the Final GEIS Summary document. The Soils and Manure TWP contains even more detailed information on this topic.

Manure storage

The Minnesota Department of Agriculture recently surveyed county feedlot officers and soil and water conservation district staff on the extent of noncompliance with the new Minnesota Feedlot Rules ,Chapter 7020. This survey encompassed 11 counties with level 2 or level 3 feedlot inventory data.

The survey found that 957 feedlots (roughly 15 percent of all feedlots) in this subset would not comply with various portions of the Minnesota Feedlot Rules. The noncompliant feedlots required either runoff controls, storage basin upgrades, or both types of correction to reduce environmental pollution. A majority of the noncompliant feedlots (47 percent) were for beef cattle, while 27 percent were dairy and 22 percent of the noncompliant feedlots were hog feedlots. Poultry operations accounted for only 2 percent of the noncompliant feedlots. The survey did not consider environmental risks associated with land application of manure or air quality, only risks of runoff and leaching from manure storage and confinement facilities.

The majority of the reported problems for beef, dairy and hogs were from smaller operations. For beef, the majority of environmental risks are probably due to inadequate runoff controls from open lots, partial housing without runoff controls, daily hauling or stockpiling operations. There may also be environmental risks due to seepage from earthen holding basins. For dairy the main environmental risks are from poorly engineered earthen holding basins and from partial housing without runoff controls, and also from winter spreading of manure in daily haul dairy operations, an indirect consequence of this storage type. For hog feedlots the environmental risks are primarily due to earthen storage basins and partial housing without runoff controls.

Manure application

In the 18 counties studied, manure plus fertilizer applied to cropland exceeded University of Minnesota recommended amounts by 16 percent N and 74 percent P. This translates into an excess of 19 lb N per acre and 35 lb P per acre beyond University of Minnesota recommendations. For the whole study region, of the excess N applied to cropland that reaches surface or ground waters, about 14 percent is from manure, while 86 percent is from fertilizer. Of the excess P applied to cropland that reaches surface waters, about 53 percent is from manure, while 47 percent is from fertilizer. Thus, controlling nutrients in surface and ground waters is not merely a matter of adjusting amounts of land applied manure. It is also a matter of making sure that the total amount of nutrients applied to the land from both manure and fertilizer is compatible with crop uptake requirements. The water quality TWP discusses excess nutrient application on a watershed-by-watershed basis.

Scoping Question 8: To what extent does Minnesota animal agriculture contribute to the hypoxia problem in the Gulf of Mexico?

Hypoxia, a zone of low oxygen levels (< 2 milligrams per liter) covered an area as large as 7,000 square miles in the Gulf of Mexico in 1997, caused in large part by influxes of agricultural N sources that support excessive growth of diatoms.

The largest source of N to the Gulf of Mexico from Minnesota is the Minnesota River basin, which generates roughly 5 percent of the total N flux to the Gulf of Mexico. The 1999 GEIS Literature Summary Water Report estimated that animal agriculture in Minnesota contributes less than 1 percent of the N entering the Gulf of Mexico. Minnesota also contributes roughly 4 percent of the total P flux to the Gulf of Mexico. Wastewater treatment plants are responsible for at least half of this contribution.

A study published since the original literature review estimates the contributions of sources in Iowa to hypoxia in the Gulf of Mexico. This study is of interest because Iowa shares similar agricultural systems, soils and climate with Minnesota. The Iowa study found that animal wastes contributed about 23 percent of the estimated total N and 52 percent of the total P to the Iowa watershed study area in 1996. Concentrations of nutrients varied seasonally, with the highest median total N concentrations in June, followed by decreases in August to October, increases in November to January, and decreases in February to March. Total P loads discharged to the Mississippi River follow the same seasonal pattern as total N, with the peak loads occurring in May. The authors speculate that the increases in spring and fall are due to field applications of fertilizer and manure at those times.

Scoping Question 9: What is the impact of animal agriculture on water quantity and availability (sustainability of water supply)? How does the use of water by animal agriculture compare with that of other industries in Minnesota?

Livestock water use in Minnesota includes water for consumption, and associated onfarm nonconsumption use for the production of milk, meat, eggs and wool. Most of the nonconsumption water use on livestock farms is for cleaning equipment and facilities, with dairy and swine farms being the largest users in this category. The total amount of water consumed by livestock each day in Minnesota is estimated to be about 50 million gallons. The total daily water use on livestock farms (including consumption) is roughly 161 million gallons per day. In comparison to water used by animals, the total water used in Minnesota for power generation, public usage, industrial processing, irrigation and other uses per day was roughly 3.25 billion gallons in 1994. The 161 million gallons of water used in livestock enterprises represents only 5 percent of the state water usage each day. Design data submitted for a proposed confined hog operation in Minnesota shows that water conservation has become a standard design factor and water use per animal is now considerably less than was normal past practice.

Scoping Question 10: How does animal manure compare to other types of wastes produced in Minnesota as a source of water pollution?

The 1999 Literature Summary Water Chapter G found that the primary sources of nutrients that cause water pollution in Minnesota include animal waste, human waste, migratory wildfowl wastes, fertilizers and recycled nutrients from the soil. The report did not consider fecal coliform, the most common cause of water quality impairment in Minnesota. Using several assumptions the relative magnitude of the impacts from each source is estimated. Among these sources, animal manure was found to be at the lower end of N production, and in the mid-range of P production. The report notes that the N and P from human waste and migratory wildfowl, while produced in lower quantities than animal waste, are discharged directly into streams and rivers, while only a small fraction of the animal waste eventually reaches surface waters.

Further, the review estimated that very little excess P is available for losses to the environment. In contrast, it identified a clear statewide excess of N applied as fertilizer and manure. However, many N sinks are unaccounted for. If the sinks do not balance this excess then the state is at a potential risk for degradation of surface and ground water quality.

The water quality TWP presents a detailed comparison of manure and commercial fertilizer to total nutrients applied to cropland. Generalized to the four river basins studied:

- For the Minnesota River basin, manure N and P represent 19 percent and 53 percent of the total nutrients available for transport to surface or ground water.

- For the Upper Mississippi River basin, land applied manure accounts for 26 percent of the N and 73 percent of the P available for transport to surface or ground water.

- For the Lower Mississippi River basin, land applied manure accounts for 12 percent of the N and 55 percent of the P available for transport to surface and ground water.

- In southwestern Minnesota, land applied manure accounts for about 12 percent of the N and 42 percent of the P available for transport to surface or ground water.

Due to a limited number of counties studied, figures for the Upper Mississippi, Lower Mississippi, Des Moines and Missouri river basins should be viewed as preliminary.

Recommendations for Water Quality Research

All the CAC consensus recommendations relating to water quality are found in Appendix D of this document. A number of technical recommendations from the University of Minnesota staff can be found in the Water Quality TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on water quality in Minnesota. There are a large number of parameters of concern to water quality which are not discussed in this document. One area requiring further research is the establishment of geographic relationships between water quality impairments and animal agriculture activities. The feedlot inventory geographic information system effort being conducted as part of the animal agriculture GEIS should help provide some of this information.

Further research is warranted in the areas of pathogenic microorganisms, toxic heavy metals and hazardous organic compounds in surface and ground water. These topics are also briefly discussed in the Human Health TWP and the Soils and Manure TWP as part of the overall Animal Agriculture Generic Environmental Impact Statement .

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Air Quality and Odor

The Scoping Document indicates that the goal of this GEIS topic is to address:

- All types of air emissions from animal agriculture
- Effects on the environment and health
- How the emissions vary by system type
- What types of mitigation are available
- What monitoring and modeling techniques and standards are available.

These inquiries are further detailed in five questions in the *Scoping Document*:

Scoping question 1: What are the types, quantities and concentrations of air emissions, including airborne microbial contaminants, from different types of livestock facilities and what are the resulting impacts on the environment?

Scoping questions 2: What are the health risks from animal agricultural emissions on neighbors, facility workers and the animals?

Scoping question 3: How do the various impacts in study questions 1 and 2 vary by species, operation, system type, management, geography and concentration of livestock facilities?

Scoping question 4: What are the current and potentially available mitigation measures and technologies for dealing with livestock-related gases, odors and other airborne emissions, and to what extent are they effective?

Scoping question 5: What monitoring techniques, modeling approaches and standards are available to detect, measure and regulate all types of airborne emissions from livestock operations and facilities? How can the validity of each be judged?

This chapter presents highlights from the 1999 Literature Summary chapter, the TWP and a number of other Minnesota Pollution Control Agency (MPCA) and University of Minnesota reports on air quality and odor. While this chapter touches on human health impacts from airborne emissions from feedlots, the bulk of information regarding study question 2 is contained in the chapter on Human Health.

Types and quantities of air emissions from animal agriculture

Numerous airborne contaminants including gases, odor, dust and microbes are produced or emitted inside and near animal production facilities and when manure is land-applied.

Numerous gaseous compounds and living organisms are generated from livestock and poultry manure decomposition shortly after it is produced or during storage.

For a comprehensive listing of 168 chemicals detected in livestock wastes for which odor thresholds have been established, the reader may consult Table 5 of the Literature Summary, beginning on page H-28. In addition, emissions may include particulate matter and dust that come primarily from the feed and the animals. Table 3.1, page 13 of the Human Health TWP presents a listing of air contaminants with potential human health impacts associated with animal agriculture and whether monitoring data is available. Table 2.1 of the Human Health TWP summarizes potential human health effects and related information for air emissions from animal agriculture and prioritizes air pollutants including hydrogen sulfide, ammonia, odorous compounds, fungi, particulates and endotoxins.

The generation rate of these gases, organisms and particulates varies depending on time of year and day, species, type of housing, manure handling system, feed type and management system. A diagram in the Literature Summary, Figure 1 on page H-46, clearly illustrates how odor emissions can vary widely throughout the day. Once these contaminants are generated these can be emitted from the sources (building, manure storage unit or cropland) through the barn's ventilation system or by natural weather forces. After these materials are emitted and become airborne they are transported downwind. Travel distance can vary greatly due to size of particles, weather conditions and surrounding topography and vegetation.

These variations have made it extremely difficult for researchers and regulators to form a clear picture of the expected emissions from animal operations. This in turn has greatly hampered efforts to deal with the contentious and emotional issues of feedlot odors and emissions in a rational, fact-based way.

Even when using best management systems and mitigation techniques, some airborne contaminants may be generated. Concentrations may build up inside livestock and poultry buildings that result in animal and human health concerns. Most concerns are associated with chronic or long-term exposure. However, some human and animal health concerns or safety hazards can result from acute or short-term exposures, like those expected during the pumping of liquid manure from a pit inside a slatted floor livestock building.

Although a great number of volatile chemicals and other substances are emitted from animal wastes, research and public concerns to date have focused on only a few of the highest priorities, such as hydrogen sulfide and ammonia. Odor, as a phenomenon apart from its constituent gases, is discussed later in this chapter. One reason that hydrogen sulfide and ammonia have been more studied may be because the Minnesota Department of Health has developed Health Risk Values (HRV) for each; there is a state ambient air quality standard for hydrogen sulfide; and there are both state and national ambient air quality standards for particulate matter, which is the form generally taken by ammonia emissions.

Hydrogen sulfide (H_2S)

Hydrogen sulfide gas is colorless, heavier than air, highly soluble in water, and has the characteristic odor of rotten eggs. Hydrogen sulfide is released to the atmosphere from natural and human sources including swamps, sea-spray, sulfur springs and volcanoes, These natural sources are responsible for about 90 percent of the H_2S in the atmosphere. Many petroleum deposits also release large amounts of H_2S when developed. Certain types of bacteria commonly found in animal and human wastes also produce H_2S through the decay of sulfur-containing organic compounds, such as proteins. Other human sources include petroleum refineries, kraft paper mills, rayon manufacturing plants and iron smelters. Once released into the atmosphere, hydrogen sulfide is easily oxidized, and can undergo reactions with a large number of oxidizing agents; the primary oxidation reaction produces sulfur dioxide. The residence time of H_2S in the atmosphere has been calculated to be 18 hours but may be as high as 42 days in winter.

Hydrogen sulfide levels in ambient air near Minnesota feedlots

Ambient air is air beyond the property line of the emitting source and may be thought of as “public air,” in that any person may breathe it.) In 1999 the MPCA reported on 435 measurements of hydrogen sulfide taken at the property line of 137 different feedlots, for a variety of animal species, facility sizes, and manure management practices. Twenty-four sites had at least one measurement that exceeded the state half-hour air quality standard of 30 parts per billion (ppb). Nineteen of the 24 were hog operations, four were dairy and one was beef; Fifteen of the 24 were large operations (over 1,000 animal units). Manure storage earthen basins showed the highest readings. These measurements were recorded using a Jerome Meter.

Earth Tech environmental consultants analyzed data sets from 1998 for the EQB as part of the Air Quality TWP contract. The consultants noted:

- The highest concentrations were near swine facilities. (This may have been an artifact of the nonrandom nature of facility selection, since many of the monitoring locations were determined by odor complaints.)
- 97.7 percent of the 30-minute average values were below the proposed MDH IHRV (Acute) for H_2S.
- 59.3 percent of the values were below the proposed MDH IHRV (Sub-chronic).
- 5.3 percent of the monitoring events were done during manure system pump-out.
- The average distance from the manure pump-out location was 885 feet.
- The average 30-minute average near a manure pump-out event was 0.031 ppm (31 ppb) H_2S.

- Thirty-minute average values at 24 facilities exceeded the State Ambient Air Quality Standard of 0.030 ppm.
- The highest of these exceedances was over 53 times the standard.

Ammonia (NH_3)

Ammonia gas is colorless, lighter than air and highly water soluble, with a sharp, pungent odor. Most ammonia emissions are produced and released into the atmosphere by natural processes, primarily through the decay and decomposition of organic matter. Among human sources, agricultural animals are considered one of the major contributors to global atmospheric ammonia emissions.

The MPCA has reported that approximately 25 percent of the statewide ammonia emissions are from animal husbandry. Protein contains amino acids, which are broken down to urea and uric acid and excreted primarily in urine. Depending upon the digestibility and nitrogen content of the animal feed, the retention of nitrogen in meat or milk and the animal category. Between 10 to 36 percent of the nitrogen in animal excreta is lost as NH_3. Because of the solubility of ammonia, most is not released into the atmosphere until the animal waste dries. Other significant sources of atmospheric ammonia emissions include wastewater treatment facilities, undisturbed ecosystems, fossil fuel combustion and other industrial processes. With increasing number and size of animal feedlot operations, the fate of atmospheric NH_3 emissions is of growing importance. NH_3 is among air contaminants that are believed to contribute to water and soil acidification and eutrophication.

The potential exists for both localized and long-range transport of ammonia, hydrogen sulfide and particulates from animal agricultural operations. Studies have shown localized deposition rates of 23 times the control site level near intensive live stock production areas. Weather conditions are likely to cause localized impacts from hydrogen sulfide and ammonia are warm, stagnant air with high relative humidity that occur during the summer months in Minnesota. Regional transport of hydrogen sulfide and ammonia depends on the persistence and reactivity of these pollutants in the atmosphere and their ability to form sulfate and nitrate fine particulate matter. The extent of the contribution of animal agricultural operations on these processes is not fully understood. These considerations point toward the need for further study of the environmental and ecological impacts of ammonia and ammonium particulate deposition at both a local and regional scale.

Odor

Odor is the most common concern downwind of feedlots and the most common source of conflict over feedlot siting or expansion. The MPCA logged 911 feedlot odor complaints between 1996 and 2000; nearly 600 were concerning swine facilities across the state; approximately 50 percent were suspected to have originated because of nine feedlots.

The only noteworthy similarity among the nine facilities is that they all operate using earthen manure storage basins. The average number of animal units housed in each feedlot was approximately 970 animal units.

As part of the Air Quality and Odor TWP the EQB asked for statistical analysis of the complaint data in relation to various factors that might have contributed to the odor incidents: unfortunately, no direct correlations could be established through the analyses done.

An odor can consist of a complex mixture of compounds. As noted, there are at least 168 different gases that contribute to swine odor. Analytical monitoring of the individual chemical compounds present in such odors is typically not practical. Therefore, researchers have considered using a few of the gases found in livestock odors as an "indicator gases." (A good indicator gas would be one whose concentration would correlate well with the human olfactory system, e.g., a high concentration of an indicator gas would result in a high concentration of odor.) To date efforts to develop an indicator gas approach to odor quantification have not been successful.

Minnesota has taken a different approach to odor problems, without trying to regulate odor itself. In 1995, the Feedlot and Manure Management Advisory Committee (FMMAC), a legislatively established advisory committee to both the MPCA and the Minnesota Department of Agriculture appointed a 12-member Livestock Odor Task Force. In February 1997 the task force produced a final report that recommended that the state develop a tool to help deal with livestock odor problems. The 1997 Legislature appropriated funds for development of a tool and a contract was awarded to the Biosystems and Agricultural Engineering Department of the University of Minnesota. This research has developed a model called OFFSET, which can be used to estimate the necessary setback distance to a receptor for a feedlot of a certain type and size.

The OFFSET model calculates the necessary distance to keep the frequency of nuisances due to odors below a certain threshold. This threshold is expressed as a percent annoyance free level; the model can calculate the setback distance required to achieve annoyance free levels of 91 percent, 94 percent, 96 percent, 97 percent, 98 percent and 99 percent. The percent annoyance free levels can be converted to the number of days per month during which annoying odors would be detected at the setback distance by assuming a length of time for the average odor incident.

To use the model, the area of each odor source at the facility (e.g., the barn and the manure storage system if the system is not the same building as the barn) is multiplied by its appropriate odor emission number and also by an appropriate odor control factor if mitigation measures are used (see next paragraph). The odor emission numbers determined by the university rate the odor emission per square foot for various types of animal species and housing combinations and manure storage systems. Odor emission numbers for some commonly used Minnesota systems are:

		Per square foot
Hogs	Finishing , deep pit	34
	Finishing , pull plug	20
	Finishing , hoop barn	4
	Finishing , open lot, scrape	11
	Gestation , deep pit	50
	Gestation , pull plug	30
	Farrowing , pull plug	14
Dairy	Tie stall, scrape	2
	Free stall, scrape	6
	Free stall, deep pit	6
Turkeys	Litter	2
Manure storage	Earthen basin, no crust	13
	Steel or concrete tank	28
	Crusted stockpile	2

There are considerable variations in odor emission ratings between types of animals and systems, but the source area is equally important in calculating the odor potential of the facility.

The model can presently take into account some types of mitigations that have been effective in reducing odor emissions (biofilters, oil sprinkling and natural crust, straw and geotextile covers) . Additional mitigation factors will be added as other data is developed. Odor control numbers determined to date are:

Biofilter (on 100 percent exhaust)		0.1 (i.e., reduces emissions by factor of 1/10)
Oil sprinkling		0.6
Natural crust on basin	- 4"	0.5
	- 8"	0.3
Geotextile cover (>2.4mm)		0.4
Straw cover	- 4"	0.5
	- 8"	0.3

Impermeable cover 0.1

The Land Use TWP (page 56) presents sample setback distance calculations using OFFSET for seven swine and two dairy facilities of various types and sizes. The results showed that setback distances suggested by OFFSET range from 0.03 to 0.3 miles for 91 percent annoyance free levels, from 0.05 to 0.41 miles for 94 percent annoyance free levels, from 0.1 to 0.75 miles for 97 percent annoyance free levels, and from 0.28 to 1.92 miles for 99 percent annoyance free levels.

A number of Minnesota counties have begun to use OFFSET to develop and apply their land use ordinances to feedlots. The OFFSET model can also be used "backwards:" if the separation distance is already known (e.g., the distance from a neighboring residence), then the maximum allowable total emission factor to avoid various levels of annoyance can be calculated and the feedlot can be designed to minimize annoyance.

Quantification of actual Emissions and Predictive Modeling

The majority of feedlot air quality measurement has been of ambient air levels, as discussed. Actual emissions of gases, odors, dust and microorganisms, measured directly at the source, have received little study in the past, but are an active area of research in the U.S. and Europe. Emission rates from buildings, manure storage units, and manure applied on cropland are difficult to determine accurately because collection techniques have not been standardized. In addition, there are a large number of contaminants to measure and the many factors and conditions at sites. Accurate emission rates are a key input to dispersion models – computer tools that are used to predict the movement and concentrations of air contaminants downwind from emission sources, in this case from animal agriculture production facilities. Emission rates of only a few gas compounds identified have been investigated. Emission factors available are probably better suited for estimating long-term average emission rates and evaluating chronic health impacts than for estimating worst case short-term emission rates, which are used to evaluate acute health effects, and upon which existing ambient air quality standards are based. Emission factors reported in past studies for various animal species and types of production system are presented in the TWP beginning on page 67.

More detailed research efforts are needed to gain a better understanding of air emissions from animal feedlots and to develop a more reliable set of emission estimating tools for the various species of animal feedlot operations. Reliable emission factors will add a significant amount of validity to predictive measurements using the available air dispersion models.

Computer prediction models estimate the movement and concentration of contaminants downwind from animal production sites. Air dispersion modeling is recognized as a valuable tool in making predictive measurements of air pollutants from a variety of industrial and municipal emission sources, and has recently begun to receive attention in review of animal production permit applications. Dispersion modeling can be used as a predictive tool for evaluating impacts from facilities that are not yet in operation, thus enabling regulators and producers to anticipate and avoid problems before the facilities are build, and to give neighbors some assurance that their well-being will not be compromised by the facilities. However, existing air dispersion models were developed to model emissions from "smokestack" industries, which generally have a more constant and standard (one or two specific compounds) emission rate. Thus, more evaluation is needed to verify that these models accurately predict contaminant levels around animal facilities.

The TWP provides information on the comparative strengths and weaknesses of various models. The TWP analysis points out the variability and uncertainty in characterizing emission rates appears to be the greatest limitation for accurately predicting and measuring air quality impacts. Two priorities for model inputs are: improved characterization of emissions from "transient" events (e.g., lagoon basin mixing, manure spreading), and improved accounting for variation of emissions with meteorology and time of day (e.g., livestock daily patterns, curtain walls).

Efforts in Minnesota to fill the information gaps.

Minnesota has been a leader in trying to find and improve tools to predict the emissions from feedlots before they are sited, permitted and built. The development of the OFFSET setback estimation tool is one such effort. In addition, there have been two other important efforts: a program to measure emission factors at a cross-section of feedlots in Minnesota , the use of air quality models to compare expected gas concentrations to air quality standards during environmental review of certain feedlots.

Stakeholders Feedlot Air Emissions Data Collection Project.

This is an ongoing project begun in 1999 by a collaborative agreement of the MPCA, Minnesota Department of Agriculture and University of Minnesota and the Minnesota Pork Producers Association, Minnesota Milk Producers Association, and Land O' Lakes Corporation (all referred to as the "stakeholders"). Its purpose is "to gather feedlot air quality information that can be used to develop effective air quality evaluation tools, models and livestock management systems in a timely manner." The University of Minnesota, sometimes assisted by outside consultants, performs annual data collection and analysis, while the other stakeholders provide funding and help set the yearly objectives. The EQB dedicated $54,000 in GEIS funds to pay for monitoring and analysis of some of the volatile organic compounds of concern in feedlots emissions during the 2001-2002 fieldwork.

Due to various delays, only the report from the 1999 field season has been completed; hopefully data and analysis from 2000 and 2001 and will also be published. One objective has been to test the accuracy of the emissions and dispersion models used in the MPCA modeling described in the next section.

Use of air dispersion models in environmental review of feedlots.

MPCA has been a pioneer in the use of air emission and air dispersion models to try to predict whether specific feedlot proposals are likely to comply at property boundaries with air quality standards for hydrogen sulfide (and sometimes also with the health risk values for ammonia and detection limits for certain odorous volatile organic compounds.) To date, the MPCA has required such modeling only as part of the environmental review of feedlots where an EAW is required and has not required modeling as part of permit review for feedlots that do not require an EAW. The emission factors used in the air dispersion models have not been taken from the literature, but instead have been calculated by a consultant from manure chemical properties using EPA techniques for estimating gaseous emissions from municipal wastewater. As mentioned in the previous section, one objective of the stakeholders was to collect data to compare measured emissions with those calculated from the manure chemistry by the technique being used in the MPCA's modeling.

The MPCA's use of modeling in the review of feedlot proposals has been controversial. Some producers have objected to the cost of modeling (which they must bear), although the cost has come down as the consultant's methods have been refined. Another point of contention is the use of emission factors calculated from manure chemistry, which some believe has not been adequately tested and should not yet be used to review specific projects. Another objection may be that Minnesota is the only state in the region using such modeling, which may be perceived as hampering feedlot expansion compared to neighboring states.

The EQB created a special Environmental Assessment Worksheet for feedlots (see the Role of Government chapter for additional details), including guidance to exempt air quality modeling if the project design includes acceptable mitigation.

Mitigation of Air Emissions and Odor

Management systems and control technologies can reduce contaminant emission rates, and their development and improvement is an area of active research. Successful technologies must be both effective in reducing contaminant emission rates and economical for use in the animal industry to find widespread application. Table 15, on page H-75 of the Literature Summary Air Quality Chapter H presents a summary of many air emission and odor control technologies.

Mitigation systems can reduce generation or they can collect or capture contaminants as they leave a source. One area of active research is dietary changes in animals to reduce emissions from their waste. Other ideas being tested include binding agents to trap contaminants, especially ammonia, in the waste, changing the pH of the animal's gut to alter the waste, and the addition of enzymes into the feed. To date most of these experiments have had disappointing results, although work continues. Dietary methods would be extremely useful mitigation, especially in existing operations if it could reduce the need for investment in costly add-on technology.

The type of manure storage system installed at a feedlot can also mitigate the generation of emissions by controlling the environment in which the wastes degrade. For example, covering liquid manure or storing it indoors generally creates fewer emissions than open-air basin storage, and generally solid composting produces fewer emissions than liquid storage.

Most mitigation measures that have been tested or suggested, however, treat emissions from manure after generation. These generally can either be built into a system when designed or retrofitted to an existing system. An example would be a biofilter, which reduces odor and gas emissions in the ventilating exhaust from a livestock building.

Another promising technology that is beginning to be used by some dairies is anaerobic digestion of waste solids to produce methane gas that is then burned to produce electricity for the operation, potentially to be sold to the power grid. Further information on manure digestion can be found in the Soils and Manure Chapter.

Everyone involved with feedlot emission issues -- producers, regulators, neighbors and environmentalists -- has an interest in the continued research and development of better mitigation measures for feedlots, better both in effectiveness and in cost and ease of application and use.

Regulatory Aspects

Historically, regulation of animal agricultural operations began with the federal and state water pollution control programs and their efforts to control non-point source pollution. These regulatory programs were initially targeted at addressing surface water quality concerns from municipal and industrial point source discharges. Agricultural water pollution had been a lower priority due to its widely dispersed nonpoint source nature. By the early 1990s, animal agricultural operations began to become larger, more concentrated, and more industrialized. With the increase in these types of facilities, odor problems became more prevalent and severe. Citizens and communities began to complain to state and local regulatory agencies about the nuisances created by these larger operations. By the late 1990s some regulatory agencies began to respond to the increase in public concern by either enhancing components of existing programs or establishing programs to address odor concerns from animal agricultural operations.

At the federal level, very little has been done to address air quality and odor issues from animal agricultural operations. Despite a recognition of air emissions as a potential concern, EPA's 1998 draft strategy for addressing environmental and public health impacts from animal agricultural operations contains no substantive provisions addressing air quality or odor issues. Consequently, states have been essentially left on their own to develop programs addressing air quality. This has led to substantial variability in the extent and stringency of state programs.

Sometimes, a program is dictated by the level of political activism that comes out either in favor of or against additional regulation. In Colorado, for instance, concerned and angered citizens were able to secure a referendum in a state election that required the state to promulgate rules to control odors at animal agricultural operations. The referendum passes and very stringent statewide regulations are now being enforced. In Iowa, on the other hand, the state legislature established an advisory committee charged with evaluating any proposed regulatory programs affecting the agricultural industry. This committee has strong representation from the farming industry and has not looked favorably on new regulatory programs. Consequently, despite having an estimated 3,000 large animal agricultural operations and receiving many odor complaints from neighbors, the state of Iowa has no virtually no program in place for addressing odors from animal agricultural operation. In 2002, the Iowa Legislature did enact stronger feedlot regulations, including a study of air quality impacts from large livestock operations.

These states represent extremes in approach. Most states have some level of odor prevention or control in their regulatory structure. In many cases, these provisions have been established within the pre-existing water quality regulatory programs. Tables 6.1 to 6.5 on pages 76 to 80 of the Air Quality TWP compare Minnesota to the five other states with respect to various air quality and odor programs.

Regulation of air emissions from this industry is at a crossroads. Historically, the farming industry has been treated like a small or area source and has not been subjected to the kind of study and regulation that a traditional large industry has been. However, farms are getting bigger and becoming more industrialized and the continued increase in size and concentration of animal operations is likely to lead to more public concern over health and other environmental impacts. Going forward, it will likely be necessary to treat these large operations in the same manner as a manufacturing industry.

An increase in the size and concentration of an animal operation does not necessarily mean an increase in odor and air quality concerns. More comprehensive management practices are essential to reducing odor and air quality problems regardless of facility size. Citizens are becoming more vocal about their concerns and in some cases are organizing grass-roots efforts to promote more stringent control of animal operations. These efforts, coupled with a lack of federal regulation or policy addressing air quality and odor impacts from animal agriculture facilities, have led to increased regulation of animal agricultural operations by state governments. This trend is occurring despite a lack of definitive information on air emissions from animal agricultural operations.

Recommendations for Air Quality and Odor Research

All the CAC consensus recommendations relating to Air Quality and Odor are found in Appendix D of this document. A number of technical recommendations from EarthTech staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional chemical, medical, epidemiological and environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on air quality and odor in Minnesota. It is important to document the source strength and environmental fate of these outputs to the extent possible or appropriate. In addition, studies of the role of best management practices in reducing risks of air quality and odor human health impacts need to be quantified to improve acceptance by producers.

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Soils and Manure

The material in this chapter is based on the 2001 Technical Work Paper (TWP) on the soils and manure topic for the GEIS and the two chapters of the 1999 Literature Summary dealing with soils, Chapter I and manure and crop nutrients, Chapter J. The Literature Summary chapters present extensive discussion of the impacts of animal agriculture on current crop production using manure as a nutrient source. The TWP provides additional material on key topics as well as a detailed exploration of the role of Phosphorus in crop production. A portion of the TWP initiated the development of a Minnesota Soil Phosphorus Index as an aid to farmers using manure as a nutrient source. Soil physical and chemical impacts from both manure and commercial fertilizers are compared in selected study regions. Interested readers are encouraged to explore the referenced source documents for additional information.

The format of this chapter is based on the study questions for the soils and the manure and crop nutrient topics contained in the Scoping Document. The soils topic addresses effects of manure application from current Minnesota livestock production systems on soil properties. The manure and crop nutrients topic includes current manure storage and application practices, the benefits and risks of manure in comparison to other sources of crop nutrients as well as the carrying capacity of soils to absorb nutrients and toxic substances. The manure and crop nutrient topic looks at virtually the same issues but from a slightly different perspective. Soil scientists are surficial geologists who look at the physical, chemical and biological interrelationships of the soil ecosystem. Farmers and agronomists focus on plant health, nutrient application, economics and logistics of the crop production system. Throughout this document the agricultural convention of representing the element nitrogen as (N) and the element phosphorus as (P) will be used.

The economic value of manure nutrients in crop production is normally considered to be greater than the costs associated with storage and application. Increasing concerns associated with the risks of excessive amounts of manure to sensitive areas have resulted in much more attention being paid to land application of manure. Revised feedlot rules have strengthened the requirements for formal manure management plans to ensure that animal waste is applied to suitable cropland at agronomic rates, while minimizing the potential negative environmental impacts. Licensing of commercial manure applicators is required by the new rules to provide increased quality assurance in manure handling.

Minnesota has an abundance of agricultural land that can use animal manure. On a regional, watershed, county, township or local basis this may not be true. Difficulties can occur when manure is land applied in areas with different rules. Some areas of Minnesota are producing more livestock than the land available to use properly the manure generated by the animals. Not all cropland that could theoretically use manure for crop production is available, due to issues of timing, owner preferences or other factors. Fewer regulations often results in farmers using commercial chemical fertilizers because it is easier than using manure.

In the rolling terrain of southeast portion of Minnesota, there is increasing interest in maintaining pasture and grazing cows to minimize the erosion from continuous row cropping. Different crops and soils, regional and seasonal factors and timing of crop nutrient needs all require consideration in customizing local manure management plans.

In addition to supplying nutrients, manure can also improve biological and physical properties of the soil, making it more productive and less erosive. Manure, when properly used as a part of a soil management program, improves soil quality, builds soil structure and increases the level of soil organic matter. It is difficult to put an exact dollar figure on these benefits. However the belief of soil ecologists is that these benefits improve the health and long-term carrying capacity of the soil ecosystem.

Scoping Question 1a: How are the different soil properties affected by manure application and livestock production systems? ***(Soil Scoping Topic)***

In the past, animal husbandry and crop production were closely linked. As these two operations become increasingly separate, manure is less likely to be returned to the cropland that fed the animals. This means that nutrients are exported from cropland, and fewer acres receive the soil quality benefits of manure application. As manure is concentrated in smaller areas, it becomes more difficult to handle as a nutrient source and its pollution potential from mishandling increases.

The effect of animal manures on a particular soil depends on a number of factors including:

- Physical, chemical and biological characteristics of the soil ecosystem.
- How much manure is applied, and from what species.
- Whether manure is applied with minimum nutrient losses.
- Whether manure is applied when soil is dry enough to avoid soil compaction.
- What crop rotation is used to feed the animals?

The best way to maintain and improve the carrying capacity of Minnesota agricultural soils is to add the organic matter in manure to its soil structure and tilth. This will also increase the soils water and nutrient holding capacity by minimizing the leaching of nutrients and the amount of soil erosion. Applications of commercial chemical fertilizer do not offer these secondary benefits provided by manure. However, composts and biosolids do. Management practices that minimize tillage operations, provide surface residues, use cover crops or manure maintain soil organic matter and improve soil quality.

Indicators of good soil quality include improved structure, increased water infiltration, pH, and soil respiration, decreased bulk density, and increased available-water holding capacity. Perennials or densely rooted forages that generate high residue improve soil quality and structure.

Organic farms, which generally use manure rather than commercial fertilizer, have higher soil quality compared to conventional farms. This is indicated by a higher percent of soil organic matter, greater organic carbon, total nitrogen, microbial biomass carbon and nitrogen, and soil respiration, and by pH values closer to neutral, lower bulk density, and higher available-water holding capacity.

Scoping Question 1b: What manure storage and application practices are in current use in Minnesota and how do these compare to the practices used in the past? To what extent do the current practices adhere to existing requirements? ***(Manure and Crop Nutrients Scoping Topic)***

The value of manure for maintaining and improving soil productivity has been recognized from antiquity. Fertilizing crops with livestock manure nutrients began many centuries ago. With careful management, manure can be a good source of nitrogen (**N**), phosphorus (**P**) and potassium (**K**) in a crop production system. Animal manures contain a broad spectrum of micronutrients required for plant growth although the levels vary widely. Manure organic matter can also improve soil quality and nutrient holding capacity. Manure applied at agronomic rates to suitable crops and soils is a great benefit.

On the other hand, improper management of land application of manure can result in negative environmental effects, including soil build-up of toxic levels of some trace elements, and pollution of ground water with nitrate-N and surface waters with P from sediment particles. Manure application can also result in microorganisms, hormones and antibiotics reaching surface and ground waters, potentially threatening human health. Human and animal pathogens can be transmitted by contamination of water and the food chain with manure and animal wastes. The risk of pathogen contamination in the human food chain is discussed in more detail in the Soils and Manure TWP and also in the Human Health TWP.

Increasing regulatory attention is being paid to improve manure management at all levels of government. Past manure application practices imposed little formal control. Significant environmental, aesthetic and economic concerns about improper manure application and storage caused Minnesota to establish more stringent feedlot rules in 2000. These updated feedlot rules include requirements for preparing and submitting manure management plans. Some licensed manure applicators are using computer technology such as global positioning systems (GPS) and customized application rates to optimize manure use efficiency. It is difficult to determine how completely livestock owners are complying with new rules during the initial implementation period. The feedlot rules are discussed in detail in the Role of Government TWP and at the MPCA web site http://www.pca.state.Minnesota.us/feedlots.html. Detailed questions on feedlot rules should be referred to appropriate MPCA staff.

Recently, concerned citizens, environmentalists and regulatory agencies have focused attention on manure nutrient management and air emissions from larger feedlots. Comprehensive nutrient management planning has the potential to improve the use of manures and minimize contamination of the environment. The establishment and enforcement of manure nutrient regulations will alter the future of livestock production. Future legislation will be likely to impose additional monitoring and record-keeping requirements on the livestock operators as citizens demand more controls. Farmers will become more efficient in using nutrients if it is in their financial best interests to do so.

A major challenge is to create flexible policies that will allow for regions, watersheds and counties to accommodate their special circumstances and needs while still providing a reasonable set of standards to minimize contamination. Proposed strategies should also accommodate site-specific needs of farming operations or environmental conditions. MPCA has taken positive steps in this direction by delegating feedlot regulation to counties wherever possible.

Successful implementation of nutrient management policy must involve full participation of a broad range of stakeholders. Major stakeholders include farmers, allied agri-industry, public agencies, regulators, policymakers, environmental groups and the consumer. Sound objectives, ongoing research, education and financial and technical assistance are critical for the success of nutrient management programs. Minnesota Extension programs are needed to disseminate the results of University agricultural research.

Scoping Question 2: To what extent is manure an asset or liability to the environment, community and the economy? What are the comparative risks and benefits of manure compared to commercial fertilizer and other sources of fertility such as legumes and sewage sludge, including comparative energy use? How does the comparison very according to geography and geology and by manure management method?

Manure can be a valuable resource in a crop production system. The nutrient value of manure for crop production depends on the site-specific reserve of plant available soil nutrients, the nutrient concentrations in manure, and the demands of the crop. The value of the nutrients in manure also depends on the value of alternative sources, normally commercial fertilizers. Most N fertilizers are produced by conversion of N from the air using natural gas. Due to the recent rise in energy prices, the cost of N fertilizer has doubled from about $.20 to $.40 per pound. It took the previous decade for the cost to double from $.10 to $.20. The increased cost of N fertilizer has a direct impact on the value of N in manure. The cost of both fertilizer P and K has also doubled in the last decade. Thus, the value of these nutrients and interest in manure have increased considerably.

The direct economic cost of manure is mainly for storage and application. Environmental costs are incurred if manure is over applied, applied at the wrong time in the growth cycle, applied unevenly, or managed in a way that allows nutrient losses in storage, handling and application. Water and air quality are often degraded in these situations. Odor from land application is a particularly difficult issue to resolve equitably. For this reason immediate incorporation of manure is highly recommended when feasible. The risks of water and air quality degradation can be reduced with investments in high quality storage facilities. Facilities reduce the environmental risk of poor containment during storage and provide for more flexibility in land application timing.

Better matching application with the time of plant uptake of nutrients. reducing the likelihood of runoff and leaching losses of N and P.

The cost for application can offset much of the value of manure if the site of application is not near the site of animal production. The cost of manure hauling increases with distance from the source, and is greater for manure with high water content compared to dryer manure. The energy expense of drying or dewatering manure reduces the appeal of this technique.

Land application of commercial fertilizer is less regulated than manure. It is just as possible to over apply commercial fertilizers and cause pollution with N, P or micronutrients. Any realistic assessment of nutrient pollution from farming operations must examine the impact of both manure and commercial fertilizers however, commercial fertilizer has no pathogens with which to be concerned. Sewage sludge (biosolids) is more highly regulated than manure, smaller in quantity, and requires additional treatment to reduce pathogens. The impact of biosolids in crop production is limited overall, but could be a concern in some situations.

For farmers, N is the most difficult manure element to manage efficiently for crop production. Availability of N largely depends on the weather (temperature and precipitation) between application and plant uptake. The uncertainty associated with potential N losses and plant availability, and the difficulty in applying manure evenly at the desired rate are reasons why farmers take low N credit from manure. This results in over application of manure or fertilizer N.

P from manure is relatively stable in soil and can be reliably measured with soil tests. Because of this stability , repeated manure applications can result in an accumulation. Although this usually does not have a detrimental effect on crop production, it does present possible environmental concerns. Excess P when delivered to surface waters through runoff can greatly increase the risk of algal blooms and degradation of water quality. The risk of P loss to surface waters is associated with runoff volume and soil erosion.

Recommended manure management practices should consider the risk of off-site movement of P to surface waters. Any manure application near surface water bodies, as well as manure applied on the soil surface without incorporation, applied at excessive rates, or applied on frozen or snow-covered ground pose a high level of risk. However, the risk is also site dependent, with erosion potential and soil P level among the considerations. The GEIS project is helping to develop the P index, an important tool for identifying sites where the risk of P loss is high. The MPCA feedlot rules prohibit the application of manure in “special protection areas” to prevent soil phosphorus levels beyond specified limits. Special protection areas are lands within 300 feet of protected waters and wetlands, and intermittent streams and most ditches identified on USGS quadrangle maps.

The quantity of manure applied is one of the most important considerations when developing a manure plan. Manure varies in relative content of N and P, and both are present as soluble inorganic forms and relatively insoluble organic forms. The composition of manure influences both crop uptake and risk of N and P losses to ground and surface waters. Most animal species have N and K contents in their manure that is greater than the P content. Poultry manure is an exception, with more P than N and K.

Energy costs of nutrient management must include material production, transportation and application of each source material. Commercial fertilizers become more economical than manure as the hauling distance increases. Economic pressure encourages farmers to apply manure closer to the feedlot and at higher rates. Water quality concerns drive farmers to apply manure further from the feedlot and at lower rates to better recover nutrients and reduce nutrient losses to the environment. Animal concentrations increase areas needed for complete manure application at agronomic rates. With liquid or semi-liquid sources (especially if nutrient concentrations are low), the transportation costs become prohibitive at distances greater than about one mile. With dry sources (the best example is poultry manure due to its high nutrient concentration and low water content) the distances with favorable economics are greater (less than 25 miles, one way).

Scoping Question 3: What is the carrying capacity of the soils in agricultural areas of Minnesota for the nutrients and toxic substances contained in manures? What is the current level of those substances in the soils in agricultural areas of Minnesota?

The most sensitive environmental regions for nitrate ground water contamination are the deep glacial outwash sands with shallow aquifers in central Minnesota. Also vulnerable are the karst areas in southeastern Minnesota where fractured limestone bedrock allow mobile contaminants enter directly into the aquifer. The relatively impermeable glacial till and glacial lakebed sediments in other major agricultural areas also pose a risk of nitrate loss to surface waters through tile drainage systems installed to remove excess water from the soil. The most sensitive areas of Minnesota to P contamination of surface waters are where slopes are steep and erosion potential is high. This includes glacial moraines such as the one just south of the Twin Cities and near Alexandria as well as the highly dissected landscapes in the southeastern part of Minnesota. Soil and water conservation techniques are important components of environmentally sound farming systems in these areas.

The concentration of P in runoff is greatly influenced by the solubility of P in manure and soil saturation with P. High rates of liquid cattle manure with inorganic fertilizer showed that both can increase runoff P concentrations when surface applied. For runoff method of P application is more important than its source. The risk of P and N transport from pastured land into streams can be reduced by exclusion of animals from the land near streams.

The University of Minnesota has extensive data on various chemical elements in state soils, including background levels of micronutrients and toxic heavy metals. Crop fertilizer recommendations are based on the short-term nutrient needs of the crop being produced. Application rates for manures and commercial fertilizers are based almost exclusively on crop N and P need. Biosolids application rates are based on long-term loading limits for several toxic heavy metals, but these analyses are virtually never done for manure or commercial fertilizer material or the soils to which the nutrients are applied. Dr. David Mulla, Soil Scientist at the University of Minnesota has provided useful nutrient budget data in the Water Quality TWP; his work covers the southeast, south-central, southwest and west central farming regions of Minnesota.

Microorganisms in manure which can potentially affect human health (pathogens) are a major concern for some people. The vast majority of agricultural research indicates the possibility of pathogen transmission from manure applied to most crops is very small. Animal pathogens that can infect humans (zoonotic organisms) are a possible risk from application of manure to fresh market fruits and vegetables. Although transmission of pathogens to produce at concentrations that can infect consumers has occurred, the existing evidence suggests that this happens rarely. Storage of manure decreases the concentration of disease organisms, especially under aerobic conditions, and generally reduces risk. The heat generated during composting essentially eliminates the risk. Risks can also be reduced by restricting fresh market produce production on recently manured land. Pathogens in manure applied to farmland are quickly destroyed or out-competed by indigenous soil microorganisms. Research conducted by many agricultural universities has shown the survival time of manure pathogens in soil is limited to hours or days under most circumstances. The issue of pathogens in manure and the possible effect on human health is addressed in the Human Health TWP.

Another increasing public concern is that manure land application avoids environmentally sensitive areas. Farmers are being strongly encouraged and sometimes required to avoid applying manure near surface waters, wetlands, wells and sinkholes. In many cases a buffer zone anywhere from 25 to 1000 feet is recommended from the edge of manure application and the sensitive feature in question. This buffer zone requirement may also be applied to homes, businesses, churches, schools and other clusters of population. Buffer distances from land application sites may also be used as a zoning tool to minimize odor and aesthetic concerns.

Of particular concern to feedlot siting and land application are areas created by karst geology. Karst describes a situation of interconnected layers of high solubility limestone rocks which can form sinkholes, solution cavities and caves in a complex and unpredictable fashion. Seven counties in southeast Minnesota show large areas of karst features which can be extremely sensitive to ground water contamination. Although it is possible to construct facilities in karst areas, additional precautions are required. As part of the feedlot rules, the 2000 Minnesota State Legislature specifically asked the MPCA to form a workgroup to study issues related to construction of manure storage lagoons in karst areas. The workgroup developed interim standards until further study on sinkhole formation can be completed. The report is available from the MPCA.

Scoping Question 4: What is the total amount and proportion of plant nutrient applied to soils in Minnesota from:

- Animal manures
- Commercial fertilizers
- Legumes
- Plant decomposition
- Sewage sludge
- Atmospheric deposition

The GEIS study was not able to obtain all the data requested in this scoping question. Anecdotal evidence from practitioners in the field indicates that commercial fertilizers and manures are by far the two most important nutrient sources in crop production from the six sources listed in the scoping question 4.

The goal of attaining high yields while protecting soil and water quality requires matching soil inorganic N supplies with crop N requirement over the cropping season. Nutrient management can reduce the N and P loss from farmland. The magnitude of nutrient loss reductions on livestock farms is contingent on unique farm characteristics, fertilizer management practices and weather. Generally, fields with poor quality soils or steep slopes have much greater nutrient losses, particularly when manure provides some crop requirements. Prudent management results in greater reductions of nutrient losses on these marginal soils.

While livestock numbers are gradually growing in Minnesota, the amounts of N and P available in animal manure are less than that needed by the corn and soybeans grown in the state. The following table assumes that corn needs about 110 lb/acre of N and removes about 80 lb/acre of P_2O_5; soybeans remove about 45 lb/acre of P_2O_5.

Animal	**Available N**	**Available P_2O_5**
	in thousand tons	
Swine	42	53
Dairy	24	20
Beef	54	73
Poultry	16	25
Total available nutrients	136	171
Nutrients needed by crops	390	424

From these estimates it is apparent that manure cannot adequately supply the N and P needs of the state=s corn and soybean crops and that there is room for more animal agriculture based on the need for crop nutrients. However, these statewide calculations should not minimize concerns about potential local surpluses in manure. Certain regions may have excess crop nutrients because of high concentrations of livestock operations. In addition to the nutrients needed by corn and soybean, there are several other crops that could make use of nutrients in manure, including alfalfa, wheat and oats.

The use of phytase, low-phytate corn, and reduction in levels of P in feed may reduce levels of P in animal manure. Reducing the level of P in manure would permit land application of manure on a regular basis to supply N requirements without causing a build up of soil P.

Swine

The amounts of N and P in the swine manure produced in Minnesota are more available due to increases in numbers of hogs, use of beneath building pits, and amounts of manure being applied to soils with an injection or incorporation system. Making some assumptions about how manure is handled, an estimate of the N and P potentially available in the manure produced by approximately 5.8 million swine in Minnesota can be calculated as follows:

Most manure is stored in under-building pits with 20 percent storage and handling losses of N. The average availabilities are 70 percent and 100 percent for N and P, when land applied with injection or incorporation. Approximately 0.07 pounds of N and 0.05 pounds of phosphate (P_2O_5) are produced by each animal per day.

Using these assumptions will give an estimate of the amounts of N and P potentially available and will overestimate the actual amounts available under current management practices. About 42,000 tons of N and 53,000 tons of P_2O_5 will be available annually in Minnesota from swine manure.

Dairy

The amounts of N and P in the dairy manure produced in Minnesota available for crops are remaining quite constant. Making some assumptions about how manure is handled, an estimate of the N and P potentially available in the manure produced by approximately 540,000 dairy cows in Minnesota can be calculated as follows:

Dairy manure is stored in earthen storage pits: one-half is stored as a manure pack until land applied with an average of 30 percent storage and handling losses of N. The average availabilities are 70 percent for N and 100 percent for P, respectively, when land applied with injection or incorporation. About 0.5 pounds of N and 0.2 pounds of P_2O_5 are produced by each animal per day.

Using these assumptions will give an estimate of the amounts of N and P that are potentially available and will overestimate the actual amounts available under current management practices. About 24,000 tons of N and 20,000 tons of P_2O_5 will be available annually in Minnesota from dairy manure.

Cattle

The amounts of N and P in the cattle manure produced in Minnesota available for crops are remaining fairly constant due to few changes in the number of cattle being raised and the way in which manure is handled. Making some assumptions about how manure is handled, an estimate of the N and P that is potentially available in the manure produced by the approximately 2 million cattle (excluding dairy cows) in Minnesota can be calculated as follows:

Cattle manure is stored in earthen storage pits or as a manure pack until land applied with an average of 30 percent storage and handling losses of N. The average availabilities are 70 percent for N and 100 percent for P, when land applied with injection or incorporation. About 0.3 pounds of N and 0.2 pounds of P_2O_5 are produced by each animal per day.

Using these assumptions will give an estimate of the amounts of N and P potentially available and will overestimate the actual amounts available under current management practices. About 54,000 tons of N and 73,000 tons of P_2O_5 will be available annually in Minnesota from cattle manure.

Poultry

The amounts of N and P in the poultry manure produced in Minnesota available for crops are remaining quite constant due to relatively stable numbers of poultry and in the way manure is handled. Making some assumptions about how manure is handled, an estimate of the N and P potentially available in the manure produced by the poultry in Minnesota can be calculated as follows:

Most manure is stored in manure packs with 30 percent storage and handling losses of N. The average availabilities are 70 percent for N and 100 percent for P, when land applied with incorporation. About 0.009 pounds of N and 0.008 pounds of P_2O_5 are produced by each turkey per day; and about 0.003 pounds of N and 0.002 pounds of P_2O_5 are produced by each broiler or layer per day.

Using these assumptions will give an estimate of the amounts of N and P potentially available and will overestimate the actual amounts available under current management practices. About 16,000 tons of N and 25,000 tons of P_2O_5 will be available annually in Minnesota from poultry manure.

Scoping Question 5: Which management, construction, storage and application techniques in Minnesota and other places maximize the positive and minimize the negative impacts of manure?

Manure nutrient management has become a major focus in efforts to maintain or improve environmental quality while sustaining agriculture production. Today, the agronomic and economic factors of nutrient planning remain central, but it also requires environmental impact consideration. Traditionally, farmers were concerned with nutrient management to optimize economic return from crop production. They applied inorganic fertilizer without giving credit for nutrients applied in manure. This practice has resulted in nutrient accumulation in the soil that exceeds agronomic requirements for crop production.

Specialization and intensification of agricultural systems has led to P accumulation in excess of crop needs in some areas. Nutrient losses from agricultural nonpoint sources are a key component of surface water impairment in the United States. N is the primary pollutant problem in many agricultural areas; however, development of management practices that reduce P loading is becoming more important in many watersheds because P is often the limiting nutrient for fresh water eutrophication. Recent literature has concentrated on nutrient management planning and implementation, P-based versus N-based manure management and nutrient dynamics modeling.

Fertilizer management practices, farm characteristics and weather influenced nutrient losses within and across farms. Manure storage, manure nutrient crediting and proper timing of manure applications are critical in reducing nutrient losses and increasing cost savings. Storage construction can build in flexibility to apply manure when and where it will be most beneficial to crops, thus reducing fertilizer applications, costs and nutrient losses.

Generally, manure is applied to agricultural land based on N recommendations, to meet N requirements of the crop. This can result in over-application of P and its accumulation in soil and consequent runoff to surface waters or possible leaching to shallow ground water.

Nutrient dynamic models have been used to describe how nutrients are cycled and stored, and to assess the effects of management practices on nutrients transported into and out of a watershed. Manure management based on crop P needs, in livestock intensive watersheds, offers sound management for reducing nonpoint source P loading. In some watersheds, with excessive P losses or soil buildup from previous land uses, P reduction is required. Composting all solid manure can reduce P loads. The choice for each watershed depends on such key factors as available land area and the load reduction sought.

The costs and benefits of all manure handling systems are site specific, relying on geographic conditions, acreage available for land application, cropping sequence, soil types, labor availability and topography. Rising energy costs and N fertilizer prices will likely play a role in future decisions regarding manure handling systems. A recent report by the Environmental Defense Fund reviewed the environmental problems in North Carolina resulting from swine lagoons and irrigation of the effluent on spray fields. The study estimated the cost of building and operating a new lagoon/spray field at $3.72 per finished hog. Costs to add advanced manure handling systems to existing lagoon/spray field systems ranged from $-0.35 to $5.21 per finished hog. Unfortunately, these cost estimates were based specifically on hog production systems in North Carolina where manure nutrient utilization is limited. This, along with the fact that these lagoon/spray fields are not used in Minnesota limits the ability for comparison to Minnesota conditions. However, the information reflects the potential for alternative manure handling systems to be cost effective.

Animal agriculture in Minnesota continues to go through significant technological and structural changes. Some changes may affect the management of manure. Local, state and federal governmental policies may need to be adapted in response to trends in animal agriculture.

General trends in manure management

Many custom manure application operators have the necessary pumps, hoses and applicators for applying manure to fields within approximately 1 mile from the storage facility. Manure can also be hauled with tanker trucks to the field and applied there by an applicator with a tote hose. The use of applicators with tote hoses is increasing in order to lower application costs and to avoid soil compaction.

With the increase in size of livestock farms, large amounts of manure are being generated at individual feedlots. This often requires feedlot operators to develop agreements with neighboring farmers to accept the manure. The financial arrangements vary depending on who applies the manure, the frequency of application, the nutrient content of the manure and hauling distance. Due to economic factors and the potential for yield increases, there is an increasing demand for manure. Many feedlot facilities were built with prior financial agreements on the use of manure produced.

Manure produced at livestock operations will be applied to land within a distance that is dependent on the costs of hauling, land ownership, other feedlots and other factors. This generally results in land near livestock facilities receiving manure on a regular basis while land farther away potentially never receiving manure. While such an effect was always present even with many more small feedlots, a change in scale is occurring so that the area of land application focuses on several hundred acres around each large facility. If P is being applied at rates greater than crop removal rates, soil P levels could rise potentially leading to increased P in runoff to surface waters.

Concerns and opposing viewpoints about the manure application rates stem from all sizes of operations. From the perspective of the feedlot operation, reducing the cost of getting rid of the manure means increased profit. From the perspective of the crop producer, applying manure at rates that maximize the efficient use of the nutrients in the manure reduces fertilizer costs and increases profits. With large livestock operations there are often agreements that link the cost of removing the manure from the feedlot with the value received by the cropland. Recent increases in the prices of fertilizers will increase these agreements. Increases in the cost of N fertilizer and concerns about shortages are increasing the demand for manure and the efficient use of N in manure. Livestock producers are getting calls from neighbors about manure availability.

Adoption of practices that incorporate the manure in the soil while protecting crop residue has been limited. When manure is applied to fields changing from soybeans to corn, typical injectors can bury much of the soybean residue. This may make the soil more susceptible to wind and water erosion. Several injectors are available that incorporate the manure while protecting the existing crop residue.

Site-specific technology for manure application is being used by some commercial applicators. This technology can be used to track rates and to apply manure at variable rates across the field, depending on site-specific characteristics. As this technology is more widely adopted, manure application can become fine-tuned to meet crop nutrient needs.

The requirement of comprehensive nutrient management planning by local, state and federal agencies has caused a significant increase in the number of manure management plans. Depending on the size and location of a feedlot, a plan for the application of manure produced will be required.

Some manure treatment systems have been adopted that reduce manure volume. Separating the solids from the liquids can reduce hauling costs and allow for manure composting and water recycling.

Several trends in the livestock industry will affect how manure is stored and applied, which will in turn affect the impact on soils. Application of manure can have beneficial impacts on soil by increasing organic matter content and crop nutrient, improving physical properties. Risks associated with manure application include compaction and excessive levels of crop nutrients, salts and pathogens.

Manure digestion

One promising new technology being used by producers across the country is the manure digester. A digester is a device that produces methane gas through anaerobic decay of the manure by bacterial action. Often, the gas produced is used to generate electricity on the farm. It reduces the need to purchase electricity, and if a surplus is generated, arrangements can be made to sell the electricity to a power company, thus generating revenue. Because the bacteria consume volatile solids, which include odor-causing compounds, digestion reduces odor generation.

As of spring 2001, 12 of 31 methane recovery systems at feedlots throughout the U.S. were participating in the AgSTAR program; one of the 12 is located in Minnesota. Most of these systems use the methane produced in manure digesters to produce electricity. The AgSTAR program is a voluntary effort jointly sponsored by the U.S. Environmental Protection Agency and departments of Agriculture and Energy, to encourage the use of methane recovery technologies at feedlots that manage manure as liquids or slurries. The AgSTAR program also provides technical assistance in planning for and building systems at individual farms on a voluntary basis.

A significant drawback to manure digesters is their large upfront capital costs. If favorable loans or other incentives can be offered, however, producers can eventually recover their capital costs through savings and revenue from electrical production. At least one other dairy operation in Minnesota plans to use manure digester technology.

Soil management

The use of drag hoses also helps control soil compaction. Eliminating the pulling of a manure tank through the field during application can help reduce the risk of soil compaction, especially under wet conditions.

As the drainage of agricultural land continues to be improved, manure will be applied on more land. Applying manure to land with subsurface drainage has both some advantages and potential risks. Improved drainage can make the soil more able to bear the weight of the manure applicator and help reduce the risks of compaction. Improved drainage can increase crop yields and the efficient uptake of nutrients from manure applied to the soil. However, there are concerns about leaching of nitrate to drainage lines. Excessive amounts of available N from over-application of manure could increase this loss of nitrate through the drainage system. There is also the concern of pathogens from manure reaching the drainage system and being transported to surface waters.

Surface inlets and blind rock inlets are another management concern in drained land. Surface applied manure without incorporation must not be applied within 300 feet of an open inlet. It is not clear how manure should be managed near rock inlets. There is also concern that manure may be injected through rock inlets because they may not be visible in the presence of crop residue after harvest. Surface and ground water contamination from agricultural tile drains is an area that requires further research.

Maintaining crop residue levels to control soil erosion is more difficult with manure application. If manure is injected with a knife or sweep injector or if manure is incorporated after a broadcast application with a tillage implement, major portions of residue such as soybean can be buried as well. Injectors that leave much of the residue undisturbed are available but have been adopted by only a few farmers due to initial increased costs, the lack of promotion by manufacturers, and a low level of concern about the risk of erosion.

Impact of changing agricultural policies on manure management

Policies by local, state, and federal governments have and will continue to affect Minnesota=s animal agriculture. Ideally, policies by local, state and federal governments should help provide guidance to animal agriculture in protecting natural resources and in keeping the industry viable and sustainable. Polices should be designed to:

- Prevent the build up of animal densities so that adequate land for manure application is available within reasonable hauling distances.
- Encourage sound management of manure so that nutrients are efficiently used by crops.
- Encourage manure management practices that minimize risks to soil and water quality .

An important role of policy is to guide the development of the animal industry. Policies aimed at preventing the excessive concentration of feedlot operations will also ward off over-application of manure, poor economic use of crop nutrients, excessive hauling costs, and other problems associated with crowding of feedlots. This would be especially true if regulations restrict the amount of nutrients that can be applied per acre.

On a statewide basis there is probably not much reason to limit the growth of animal agriculture. The state still has ample land to handle the application of nutrients contained in animal manure. However, there may be a problem with the uneven distribution of feedlots across the state.

On a county level, the process for registration and permitting of feedlots, administered through the county and the state, can ensure that adequate land is available for the application of manure produced in the feedlots. This will probably remain the primary way of preventing excessive amounts of livestock in a region.

On the field scale, there is still a need to encourage more efficient use of the nutrients. Present regulations require adequate amounts of land for manure application based on N. Record-keeping requirements will be a strong incentive to apply manure at rates that do not exceed the N needs of the crop. However, incentives and educational programs may be needed to achieve better management for P. Farmers faced with increased hauling costs to apply manure to more remote fields, may need encouragement to avoid the build up of soil P levels.

Storage requirements can have a significant impact on manure management. Many livestock operations that need to apply manure on a frequent basis have to apply it during less than favorable conditions. These manure applications can result in soil compaction, loss of nutrients and exposure of the manure to risks of runoff losses. Requiring long-term storage facilities is a complex economic issue due to the cost associated with their construction. Cost sharing has been an effective way for helping farmers improve their manure storage facilities.

Encouraging adoption of methods to reduce N and P manure contents

Phytase in swine feed is effective in reducing the P content of manure by about one-third. However, there is little financial incentive to use phytase at this time. There are new strategies in decreasing the P content of dairy manure as well. Nonregulatory methods may be helpful in increasing the use of phytase and adopting of other strategies to reduce P in manure.

Reducing risks associated with pathogens in manures

Considerable information is available on the risks of pathogens from manure getting into the food chain. While the risks are generally quite low, fresh fruits and vegetables that come in contact with soils that have received manure application may become carriers of pathogens. Methods for reducing these risks should be promoted where necessary.

Adjusting for new technologies

Policies need to be able to account for the development of new technologies in manure management. Changes in feeding, processing manure, handling and applying manure, and soil and crop management may lead to new methods of reducing environmental risks and protecting soil properties. Policies should be flexible enough to adjust for these developments.

Phosphorus Index For Minnesota

In completing the GEIS several issues or questions required further research to provide a more definitive answer. One such issue was the appropriate level of P for each Minnesota soil. To help answer this question the GEIS provided the initial funding for a three-year research program at the University of Minnesota to develop a P Index for Minnesota soils. The results of this P Index study will provide a tool to Minnesota farmers using manure as part of their crop fertilization.

Environmental policies of the past three decades have significantly reduced the amount of P entering surface waters from point sources. However, eutrophication of fresh waters due to transport of excessive amounts of P from nonpoint sources such as municipal and agricultural activities is still a major environmental concern.

Many states have established threshold soil test P levels that limit application of additional P in soils exceeding the threshold. The movement of P from agricultural soils to water bodies is influenced by many factors and a more holistic approach is needed for protection of vulnerable water bodies. In response to that need a group of researchers from universities and government agencies in the early 1990s developed the concept of a P Index. The original P Index was introduced as a screening tool to rank various agricultural fields with respect to their vulnerability to off-farm P loss. The P Index developed for Minnesota will be an important means of accomplishing water quality goals by focusing resources and efforts on areas with the highest potential for transport of P to surface waters.

Recommendations for Soils and Manure Research

All the CAC consensus recommendations relating to soils and manure are found in Appendix D near the end of this document. A number of technical recommendations from the University of Minnesota staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on soil and water quality in Minnesota. There are a large number of parameters of concern to soil and water quality which are not discussed in this document. Further research is warranted in the areas of pathogenic microorganisms, toxic heavy metals and hazardous organic compounds in soils, surface and ground water. These topics are briefly discussed in the Human Health TWP as part of the overall Animal Agriculture Generic Environmental Impact Statement.

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Human Health

Text for this chapter was extracted from the 2001 Final Technical Working Paper on Human Health and the 1999 Literature Summary on Human Health, Chapter K, reviewed and revised by staff of the Minnesota Department of Health. The chapter format is based on the study questions for the human health topic in the Scoping Document. The human health topic addresses the health and well-being of people exposed through various paths to toxins and pathogens from animal agriculture systems.

Animal agriculture has potential to impact human health through air, water, soil and food which has led to public concern. Agricultural outputs that can affect human health are discussed at length in the Human Health TWP. This summary covers outputs for which two or more of the following conditions were met:

- The output has documented serious adverse health effects in humans or strong evidence of serious effects in test animals.

- Sufficient off-site transmission to cause adverse health effects has been demonstrated or can be reasonably expected.

- The well-being of a significant number of people off-site is likely to be negatively impacted.

The reader is referred to Table 2.1 of the Human Health TWP for a description of outputs transmitted through air and to Table 2.8 for a description of outputs transmitted through soil and water.

The public's sensitivity to the increasing industrialization of animal agriculture in Minnesota has put enormous pressure on policy-makers, regulators and the animal agriculture industry to answer complicated questions regarding the environmental health impacts of larger animal feeding operations. It is challenging to address these questions because of the paucity of data concerning human exposure and subsequent health effects of many of the outputs, and the lack of capacity to measure outputs and predict their fate in the environment. Ongoing research in the many human health issues associated with animal agriculture is recommended by the CAC as a very high priority.

Scoping Question 1: What are the current regulations and practices in Minnesota related to animal agriculture production that are aimed at the protection of human health? What is known about the use of these practices or compliance with regulations? What is known about the effectiveness of the regulations and practices?

The new Feedlot Rule Ch. 7020, recently adopted by the Minnesota Pollution Control Agency, contains construction and operational requirements to protect the environment from outputs from feedlot operations. Although there is not a stated goal of protecting public health, the new feedlot rules provide tools that can help achieve public health protection.

Construction specifications, particularly those for waste-holding structures, manure management plans, mandated use of Best Management Practices and air emissions plans are helpful for protecting public health. However, even with the strengthened feedlot rules there are provisions which could allow negative public health impacts to occur. It is problematic that these statutory changes have resulted in the exemption of facilities with less than 300 animals units from some permit requirements. The new feedlot rules also allow the exemption of regulated facilities from the hydrogen sulfide air quality standard for a three-week period during pit or lagoon clean-out. Data in the Water Quality TWP clearly demonstrates the significant role that many smaller feedlots play in the degradation of water quality. Air emissions during manure pit clean out are also likely to be well above the hydrogen sulfide standard and these need to be mitigated. The enabling statute of the feedlot rule directs the development of special construction standards to protect sensitive geologic areas from contamination by feedlots. Special standards have been developed for karst geology areas and are proposed to be developed for other vulnerable areas.

State and county regulators are responsible for implementing the new rule. They have been constrained by a lack of resources from establishing a thorough regulatory program, which would include permitting, inspection, monitoring and analysis, modeling of discharges and emissions, and enforcement. According to a 1999 report by the Minnesota Legislative Auditor, many of the feedlot regulators' field activities have been driven by complaints. which results in a bias in the data collected. It is important that more representative environmental data collection occur at feedlots or it will not be possible to determine the effectiveness of the new feedlot rule in terms of either environmental or public health protection.

Other Minnesota programs and regulations have a stated goal of public health protection. The Well Code, Drinking Water Protection, and Source Water Protection programs all focus on safeguarding public health by assuring the integrity of the systems that provide drinking water. The Safe Drinking Water Act establishes standards that limit the amount of contaminants allowed in public water supplies. The Well Code requires that all new wells be tested for bacterial and nitrate contamination. The Source Water Protection Program identifies surface areas that need to be protected around a public water supply, in most cases a well, but also surface waters used as drinking water, to assure that contaminants do not travel to the well or intake. All of these programs apply statewide, have high compliance rates and are generally considered effective. These programs also apply to all feedlot facilities.

The Department of Health establishes standards that risk management programs of the MDH, MPCA and MDA use to provide public health protection in their regulatory programs for air, water and pesticide use. The Department of Agriculture, working cooperatively with the Department of Health, has sponsored a number of successful water quality clinics in rural Minnesota. Residents bring their water in to be tested for nitrate levels and receive advice on potential problems of well construction and well placement that could be causing elevated nitrates in their supply. One weaknesses of state programs designed to protect the environment and public health is a lack of understanding their purpose or their interrelationships by the public or by producers. However, there seems to be an awareness that high nitrate levels cause illness in infants and many private well owners do routinely have the quality of their well water tested although there is no requirement to do so.

There is also a general lack of appreciation for all the independent work going on at state and federal agencies, nongovernmental organizations, academic institutions, by producers and industry groups to ensure food safety, develop new techniques and technologies, assess health risk, disease occurrence, disease transmission and emerging issues such as antibiotic resistance. New findings may well result in the need to make regulatory changes.

Like the United States, countries around the world are struggling to find the right combination of laws, policies, and education to protect their citizens as well as to provide support for their agricultural sectors. The European Union has taken a leadership role in the management of water pollution from animal agriculture and has set a timetable to meet pollution reduction goals.

Many regulations and practices are related to animal agriculture. In general, these can be divided into four main areas: animal production, animal transport, animal products processing, and animal products sale. When thinking about protecting human health, it is most relevant to look at issues related to animal production, and the processing and sale of animal products, or in other words, meat safety. This section focuses on issues of regulation and practices related to those areas. The Literature Summary and Human Health TWP also briefly discuss animal agriculture regulations and practices in nations other than the United States.

Regulations and practices related to antimicrobial use: USDA/FSIS conducts mandatory residue testing of meat and milk prior to further processing. There are also intensive educational efforts by USDA and the livestock industries (mostly as result of quality assurance programs for pork, dairy, poultry, etc. on a national or state basis) on antimicrobial use.

Airborne emissions, and hydrogen sulfide state standards: Federal, state and some local governments regulate ambient concentrations of specific gases and dust. See the GEIS Literature Summary, Chapter H, Air Quality and Odor , for a detailed summaries of various state hydrogen sulfide and odor standards.

Ambient dust emissions: Ambient dust is regulated by the U.S. Environmental Protection Agency under the National Ambient Air Quality Standard. Emissions from large beef cattle feedlots in Texas and California are regulated at the state level.

Regulations and practices related to disease control: In spite of the potential for transmission of diseases to humans from animal production, little regulation is practiced.

In protecting the health and well-being of animals, human health is also served. Information on regulations is found in the animal health report, GEIS Literature Summary, Chapter L, starting with section B.

Regulations and practices related to worker safety: Mandatory regulations to prevent injuries or illness may be internal policies and procedures developed by the employer, or external regulations enacted through the Occupational Safety and Health Act. Coverage of the federal OSHA, which is provided through a state approved plan in 38 states, does not extend to all farming operations. Certain farms are protected from enforcement of rules, regulations, standards or orders under OSHA, as stated in the 1996 Department of the Interior and Related Agencies Appropriations Act. Funds appropriated for OSHA may not be "expended to prescribe, issue, administer, or enforce any standard, rule, regulation, or order under the OSH Act of 1970 which is applicable to any person who is engaged in a farming operation which does not maintain a temporary labor camp and employs ten or fewer employees."

Scoping Question 2: What are the human health effects with regard to the use of antibiotics, heavy metals and other chemicals in livestock production?

Antimicrobial resistance: Increasing antibiotic resistance in bacteria relevant in human diseases has been a controversy for decades, but only recently have studies clearly indicated that animal feeding practices are involved. Some animal pathogens, which are resistant to antimicrobial agents, including antibiotics, are transmitted to humans. These are called zoonotic pathogens. Five published studies have demonstrated the link between antimicrobial use in food animals and the transmission of resistant Campylobacter to human patients, including a 1999 study in Minnesota.

A brief synopsis of especially recent events in this area is provided below. In February 2001, the Food and Drug Administration proposed a ban on fluoroquinones, a family of antibiotics which are widely used in poultry production. The flouroquinone family includes Cipro, the drug of choice for treating anthrax infections in humans. The reason this is important is that microorganisms have the disturbing ability to develop resistance to one drug of a given class and then quickly evolve resistance to closely related drugs of that class. This ability becomes even more dangerous because different species of microorganisms that are found in the same environment have a process of antibiotic plasmid exchange which allows these creatures to trade promiscuously antibiotic resistance around among microorganisms of different species. Low levels of antibitoics in the food, manure, soil and water encourage and promote the development of a widespread antibiotic resistance among many species, some of which could include pathogens that can infect human beings. Microorganisms are able to develop drug resistance much more quickly than scientists can develop new drugs.

In June 2001, the American Medical Association endorsed the phaseout of "subtherapeutic" antibiotics in livestock. There is strong medical evidence to indicate that continuous use of antibiotics in animal agriculture will eventually reduce the drug's efficacy in human beings. The Union of Concerned Scientists release a book called "Hogging It" in February 2001 where they present considerable statistical information on the amounts and distribution of antibiotic use. In the October 18, 2001 issue of the New England Journal of Medicine, there are three articles and an editorial on the use of antibiotics in animal agriculture and its potential impact on human health. There is probably a great deal research on this topic currently underway. There is no doubt that this emerging issue has assumed much more importance in light of the recent terrorist attacks on the United States in September and October 2001.

Antibiotic resistance results from the development of or transference of genes that allow bacteria to circumvent the antibiotic action of a given drug. Such changes may occur spontaneously, by mutations in the bacterial genetic material (DNA). Resistance is also spread is through a form of microbial sex called transformation. Bacteria share parts of their genetic material through conjugation (attachment of one cell to another). Another method is by transference of a small circle of DNA (called a plasmid) from one cell to another. In this way, resistance can be spread from one bacterial species to another. The more widespread microbial antibiotic resistance is, the less effective antibiotics become in treating human infections. This means more severe infections and greater mortality, especially for the very young, the very old and those with compromised immune systems. There is also the added expense of higher health care costs we must all share due to this phenomena.

Transfer of antimicrobial-resistant Salmonella species from animals to humans has been demonstrated by the Centers for Disease Control and Prevention and at least five other peer-reviewed studies. Other species that may potentially develop resistance include Escherichia coli O157:H7, Yersinia enterocolitica and Listeria monocytogenes. The 1999 MDH study documented resistance to fluoroquinolone-type drugs. Prompted by an apparent increase in fluoroquinolone-resistant Campylobacter jejuni infections, the MDH carried out a case-control epidemiology study to understand the underlying factors for the increase in resistance. Minnesota investigators reported that only 15 percent of the resistance could be traced to previous therapeutic use of fluoroquinolones in the infected persons (Smith, 1999). The team also tested poultry products in retail outlets, and found high rates of infection with fluoroquinolone-resistant Campylobacter jejuni.

Subtherapeutic doses of antibiotics and other antimicrobial agents have been increasingly used in U.S. food animals during the latter half of the twentieth century. The U.S. Food and Drug Administration has approved the routine use of many antimicrobial agents in animal agriculture to reduce the likelihood of infection and to promote growth. The most common route of administration is in the feed. Since such dosages are subtherapeutic, administration in feed has typically been done without direct intervention of a veterinarian. The American Medical Association has recently taken a strong position against the excessive subtherapeutic use of antibiotics in animal agriculture.

The most promising area for reducing the rate of microbial resistance to antibiotics is in the use of competitive bacteria which is added to feed to promote the growth of normal bacteria and exclude pathogenic bacteria in food animals. These agents, called probiotics, will most likely see a significant increase in use over the next 10 years, and may replace some of the nutritional uses of antimicrobial agents.

Heavy metals: Many metal-containing compounds are added to animal feed, often in the form of antimicrobials to improve animal health. Most of these metals are essential nutrients that can be toxic at high concentrations. A non-nutrient metal, arsenic, is common in poultry diets. These metals are excreted in manure and could potentially pose a risk to human health if they are transported in excessive amounts to surface water or ground waters. In addition, some metals are known to bioaccumulate in fish which is a significant health risk for those who rely on native fisheries as a significant portion of their protein. Although there is a potential risk to human health, there is no documentation that adverse health effects have occurred from exposure to heavy metals resulting from animal agriculture.

The toxic effects of chronic exposure to excess arsenic, copper and zinc are well documented and are presented in Human Health TWP, Table 2.8. The 1993 USEPA 503 sludge rules set limits on the concentrations of these metals in sludge and on the quantity that can be applied over the lifetime of a site. It is unlikely that any manure would violate the ceiling concentration limits, but with long-term application the loading limits could be exceeded. Assuming average metal contents in manure with 30 percent moisture, at an application rate of 10-12 tons per acre, the limits would not be exceeded for zinc in 388 years and for copper in 660 years. For poultry manure, which is higher in arsenic, the limit for arsenic would be exceeded in about 100 years.

Chemical residues, carcinogens and pathogen movement: Chemical residues in food have long been a health concern. Leading to mandatory residue testing of meat and milk and educational efforts by U.S. Department of Agriculture (USDA) and the livestock industries. Antibiotic residues in food are a problem of much less significance than the development of resistant strains of pathogens in living animals. The initial emphasis of regulation was to prevent the introduction of toxicants or carcinogens into animals that might persist in food products ingested by humans. There has been recent evidence that bacteria with antibiotic resistance have been able to move some distance in soil and ground water from large feedlots.

Scoping Question 2b: What are the human health effects with regard to the transmission of gases, dust, odors, and pathogens through the air?

Feedlots contribute to the airborne contaminants in the rural environment. These airborne contaminants may include gases, dust, odors and disease-causing organisms (pathogens).

Gases

Animals produce gases directly through their metabolism and indirectly through decomposition of their waste products by microorganisms (bacteria and fungi). If the waste storage facility is not aerated, the types of microorganisms that can grow in the waste are adapted to survive with little oxygen, and are called anaerobic. The products produced by anaerobic decomposition are often very odorous and irritating. Decomposition of manure in storage structures yields the following percentages of gases :

1. Methane (60 percent)
2. Carbon dioxide (40 percent)
3. Ammonia (NH_3) (trace percent to ppm)
4. Hydrogen sulfide (H_2S) (trace percent to ppm)
5. Various other gases, including odorants (trace percent to ppm)

Methane (CH_4) and carbon dioxide (CO_2) are greenhouse gases and are likely to be of greater concern in the future as society grapples with climate change impacts. Methane is flammable and a simple asphyxiant gas (displacing oxygen), and CO_2 is relatively nontoxic. The two primary gases of concern are NH_3 and H_2S. These two gases are well documented as resulting from animal waste and significant environmental and human health impacts from the transmission of these gases in air and other routes. Both NH_3 and H_2S are also associated with the odor of livestock waste.

Ammonia (NH_3) is a strong respiratory irritant. Protein consumed by animals is the primary source of NH_3 in animal waste. Protein contains amino acids, which are broken down to urea and uric acid, and excreted from the bodies of mammals and poultry. The use of quaternary ammonium compounds for sanitation may produce a very small portion of the NH_3 detected in livestock buildings and waste structures.

Ammonia is stable in liquid solutions and often is not released until the waste dries. For this reason, NH_3 is unlikely to reach an immediately dangerous or life-threatening concentration during agitation of waste in manure storage structures. Due to the strong odor and irritant properties of NH_3, people exposed to concentrated sources of NH_3 typically remove themselves from exposure. Levels of 2,500 to 6,000 parts per million (ppm) are fatal, due to pulmonary edema. Most cases of fatal exposures to NH_3 are due to exposure to anhydrous ammonia released from compressed gas cylinders or from NH_3 refrigerant systems.

Monitoring of NH_3 has been conducted widely in animal confinement feeding operations. Based on studies of declining of lung function in poultry workers and environmental parameters, There is a demonstrated dose-response relationship between occupational exposures to dust and NH_3. Little ambient data for these contaminants are available for areas downwind of facilities.

Hydrogen sulfide (H_2S) exposure can be more serious than exposure to NH_3, since it affects the body's uptake of oxygen (O_2) by poisoning the blood-forming tissue and acts as a chemical asphyxiant, preventing the proper transport and use of O_2 in the body's metabolism. Sulfur compounds in animal feed that end up in livestock waste include H_2S and other reduced sulfur gases. At high levels of exposure, the odor of H_2S does not give adequate warning of hazardous concentrations because olfactory fatigue (the inability to smell H_2S) occurs after exposure to concentrations in the range of 100 to 150 ppm. At lower levels of exposure, H_2S exerts a reversible effect on the respiratory system, increasing airway resistance and decreasing airway conductance. The Minnesota Department of Health (MDH) has proposed an Inhalation Health Risk Value (IHRV) for H_2S of 0.06 ppm (60 parts per billion), to prevent acute effects and 0.007 ppm (seven parts per billion) to prevent subchronic effects.

Many of the confined space fatalities in manure pits have been attributed in part to exposure to high concentrations of H_2S. Hydrogen sulfide exposure from manure pit entry caused nine fatalities between 1994 and 2000. Many of these fatalities occurred on relatively small facilities, thus, the hazard does not necessarily increase with facility size. Controlling the potentially fatal effects of H_2S in confined spaces in which manure is stored should be a priority in future regulation in Minnesota.

There is more Minnesota ambient H_2S monitoring than NH_3 ambient monitoring although little information was available on typical H_2S concentrations within feedlots buildings. The MPCA has conducted screening level H_2S monitoring near feedlots to document typical concentrations for various types of facilities.

A 1992 literature review by O'Neill and Phillips cited in the 1999 GEIS Literature Summary, Chapter H, Air Quality and Odor, identified 168 volatile organic compounds (VOCs) that have been detected in and around livestock facilities or livestock wastes. Their review was concerned mostly with odor nuisance, but some volatile compounds have been shown to have adverse health effects apart from those associated with odor. The Literature Summary provides a complete listing of the 168 chemicals identified.

One of the great difficulties in air quality management is that only eighteen of the 168 feedlot-associated VOCs have documented USEPA or state agency inhalation toxicity values which define the levels that humans can be exposed to without serious acute or chronic consequences. The lack of this kind of information about human health impacts is a significant barrier to establishing limits that protect public health. In addition, most regulatory agencies do not have the capacity (equipment or analytical capacity) to measure VOCs that have health impact data. Thus, there is little quantitative information on the air concentrations of these chemicals inside feedlot buildings or in the ambient air outside of these facilities and limited capacity to model the dispersion in compounds that may be emitted off-site into the ambient environment. The limited ability to determine health effects at specific facilities is a significant problem.

There are major differences in air quality across the state. However, the mean concentrations of selected air toxics are lower at all rural sites than at sites located in urban areas. There is evidence that the ambient air concentrations of some volatile chemicals are higher in rural areas that have high feedlot density as compared to rural areas with low feedlot density. The MPCA monitors 75 air toxics at a number of locations in Minnesota. Three monitoring sites that report VOC concentrations are located in southern Minnesota rural areas with high feedlot density: Pipestone, Granite Falls and Zumbrota. Concentrations of VOCs at these sites are lower than at the monitoring site in Warroad, a rural northern Minnesota community with little agricultural activity.

Dust

Fugitive dusts from wind erosion of manure-amended soils contain the same outputs as those emitted directly from feedlots. These dusts can be inhaled by neighboring residents, and the dusts can settle on crops, posing a potential risk to humans through ingestion of pathogen-contaminated food. Also, the dusts may recycle pathogens to animals through inhalation or ingestion of dust-laden crops. The potential human health effects related to inhalation of dusts are discussed above. Various researchers have tried to characterize the dust associated with agriculture, including crop farming, livestock and poultry feeding operations. In general, the types of dusts include inorganic and organic dusts.

The effects of inorganic mineral dust exposure include acute and chronic bronchitis, chronic obstructive airways disease, and interstitial lung disease. Soils contain silicates, calcium carbonate and free (crystalline) silica. The mineral dusts in rural environments apply to any agricultural activity that disturbs the soil. Although animal agriculture contributes to the overall load of inorganic dust, the greatest contribution is crop farming, due to the large amount of soil that is disturbed. This effect should be less pronounced in confinement feeding operations where there is less exposure to soils.

The potential chronic effects of off-site exposure to inorganic dusts related to animal agriculture needs to be studied further. In the absence of monitoring data, it is believed that continued exposure to relatively high concentrations of silica-containing dust can lead to interstitial fibrosis (silicosis). The size of the dust particle is related to disease causation. To have PM_{10} or less, silica needs to be ground, pulverized or mechanically acted upon. Another area needing more research is the role of $PM_{2.5}$ particles. Reportedly, a significant amount of the ammonia from feedlots reacts with sulfur oxides to produce ammonium sulfate, which is in the $PM_{2.5}$ size range.

Organic dusts are of greater concern in the short-term, because of their ability to develop an immunological reaction to these agents in ways that inorganic dusts do not. Exposure to organic dusts is associated with asthma, rhinitis, bronchitis, hypersensitivity pneumonitis, and organic dust toxic syndrome. Symptoms of ODTS include fever, chills, headache, cough, chest discomfort, breathing difficulty, muscle aches and possible nausea. Organic dust includes bacteria, endotoxins, fungi, mycotoxins and allergens. See pp. 21-24 of the Human Health TWP for more discussion on organic dust.

Odors

Many of the gases and vapors emitted from animal feeding operations are odorants. In other words, they are chemicals that the human olfactory system (nose) can detect. The receptors for the sense of smell are located in the mucous-covered olfactory epithelium in the nasal passages. These receptors are specialized bipolar neurons with cilia that protrude into the mucous layer and connect to the olfactory bulb, which projects into the primitive cortex. The areas of the primitive cortex that process odors also process emotional information. Strong odors are reported to stimulate electrical activity in the amygdala and hippocampus portions of the limbic system, whose most important role is the regulation of temperature and blood circulation through the hypothalamus. Stimulation of these limbic networks is believed to be involved in triggering of the primitive "fight or flight" response associated with panic disorder.

Most odorant substances associated with animal feeding operations are volatile organic compounds, although ammonia and hydrogen sulfide are notable exceptions. Table 2.4 of the Human Health TWP presents 26 VOC's that have been identified in the exhaust from livestock facilities out of the 168 compounds associated with animal waste.

Odorant molecules in a gaseous state or adsorbed to dust particles can cause nasal and respiratory irritation. Research shows that nasal irritation can elevate adrenaline, which can convert mild annoyance to irritability tension, and anger. The fact that some odorant compounds are irritants or VOCs can complicate the assessment of potential health effects, especially in susceptible populations. People reporting chemical odor intolerance are more likely than the general population to report a history of hay fever. They are also most likely to report upper and lower respiratory discomfort when exposed to smoke and exhaust particulates and VOCs. Some odorants may stimulate the trigeminal nerve, which can result in respiratory irritation, while other odorants appear to stimulate other receptors. Odorants can exacerbate the effects of asthma, but it is not known whether they can induce new cases of asthma. Clearly, more research is needed on chemical intolerance and on understanding the mechanisms of odorant activity on the respiratory system.

Schiffman and colleagues at North Carolina State University reported that people living near a large swine feeding operation in North Carolina reported significantly more of the following psychological effects: tension, depression, anger, decreased vigor, fatigue and confusion.

Pathogens

Although airborne pathogens are certainly a potential risk for farmers and other individuals with occupational exposure to animals, there is no direct evidence that individuals living near feedlots are at increased risk for developing diseases associated with pathogens transmitted via the air from these facilities.

Microorganisms have been shown to be transmitted considerable distances through dispersion. However, their ability to initiate and spread disease depends on their ability to survive and cause infection. Survival is a prerequisite for infectivity, but the attributes that allow for infectivity are more easily lost through environmental stress. Potential stresses to microorganisms that may affect their ability to survive or remain infective include humidity, temperature, radiation, oxygen and pollutants.

Organisms that cause food borne illness could potentially be transmitted via flies from animal production facilities to human food and cause disease. While air emissions of enteric bacteria from animal confinement facilities increase their population in the environment, there is insufficient data to determine if this results in an increased risk to human health.

Scoping Question 2.c What are the human health effects with regard to the transmission of disease and sickness via water, soil, flies and from manure, dead animal carcasses, and other animal wastes?

Water and soil

Animal manure may contain nitrogen compounds, bacteria, protozoa and viruses which can cause disease in humans. These pathogens may be transmitted to humans through contaminated surface drinking water supplies, contaminated ground water supplies, or direct contact with the contaminated environment e.g., recreational use of water. See page 2-3 of Appendix A of the Human Health TWP for more detail regarding specific outputs in soil and water that may influence human health.

Nitrate is a common contaminant found in many wells in Minnesota. Nitrate occurs in animal agricultural operations primarily as a result of animal waste products. Ammonium nitrogen in animal urine and organic nitrogen in solid wastes are converted to nitrate by soil microbes. Nitrate is not readily held by soil, particularly coarse soils, and can leach to ground water. In addition, nitrates can be added directly to soil as inorganic fertilizers in agricultural operations.

Human health effects from exposure to nitrates of agricultural origin are well documented. The principle effect, methemoglobinemia (blue baby syndrome), was first documented in 1941. This syndrome results from overexposure to nitrates, causing the displacement of oxygen in the bloodstream. Infants are most susceptible to the disease, hence its name. Since its initial identification, numerous cases of exposure have been reported, as recently as the 1990s. Virtually all cases resulted from ingestion of drinking water contaminated with nitrates.

Currently, drinking water standards established in the U.S. and elsewhere continue to be based on prevention of methemoglobinemia. The current Maximum Contaminant Level (MCL) for nitrates in drinking water is 45 mg/liter (as nitrate ion) or 10 mg/liter (as nitrogen). The USEPA initially established this standard under the Safe Drinking Water Act in the mid-1970s. The standard was re-evaluated in 1987 and determined to be protective of public health.

Nitrates are generally not a significant component in runoff from agricultural operations, but that they can be found in significant levels in subsurface tile drain effluents when manure is applied to fields as fertilizer. Seepage from manure holding basins and lagoons as well as spills of liquid manure and fertilizer can result in significant impacts of nitrate to ground water, especially in areas of karst geology and coarse sandy soils. Proper management and prevention of excessive nutrient inputs to soil is critical to the reduction of nitrate contamination in ground water.

Surface and ground water contamination from agricultural outputs often occurs secondarily to soil contamination. Irrigation with contaminated water recycles the manure components to the soil. Soil and water serve as vehicles for transmission of agricultural outputs to other environmental media as well, such as ambient air and crops consumed by humans and animals. The agricultural outputs to soil and water are generally associated with animal manure and dead animal carcasses.

Animal manure contains pathogens such as bacteria, viruses and protozoa that potentially cause disease in humans. The type and number of pathogens depends on the source animal, the animal's state of health, and how the manure was stored or treated prior to use. Exposure to the environment inactivates many manure organisms. Any zoonotic disease spread through contact with feces could theoretically be soil- or waterborne. Soil pathogens spread to ground water through leaching or to surface water through runoff after rainfall or floods. The very young, the elderly, pregnant women, and people with compromised immune system (such as people receiving chemotherapy and those with AIDS) are especially susceptible. Fewer organisms are required to cause disease in these individuals, and once contracted their infections tend to be more severe.

Certain assumptions can be made regarding the transmission of animal viruses through water:

- Large numbers of viruses are excreted in infected animal feces.

- If virus-contaminated water becomes immediately accessible to susceptible individuals (which may be humans or other animals), viruses may induce active infections.

- Problems may not exist in areas where treatment of water supplies is adequate. However, in many parts of the world, humans and other animals share the same water holes and streams as primary source of water.

- Certain viruses produce a benign disease in their natural hosts but may cause cancer or even be fatal in other animal species.

- Any virus excreted in feces and urine is potentially capable of being a waterborne disease. Farm animals are known to excrete a variety of viruses in their feces; many are pathogenic and some may be transmissible to humans.

- To establish virus-contaminated water as a significant link in the epidemiology of animal virus disease, it is necessary to study virus survival in water under natural conditions. A cost-effective, efficient method for testing for the presence of animal viruses, similar to fecal coliform testing, is also required.

Protozoans, such as Cryptosporidium parvum also cause disease in humans. Many different species of animals shed C. parvum oocysts, including cattle. A recent waterborne Cryptosporidium outbreak in Milwaukee caused over 100 deaths and 400,000 cases of illness. This epidemic episode has had a major negative economic impact in the Milwaukee area.

Pathogen content of soil is not regulated. Fecal coliforms, which generally do not cause disease in humans, are used to indicate the presence of other pathogens in surface and ground waters. The limit for fecal coliforms in surface water is 200 Colony Forming Units per milliliter (CFU/ml). Studies have shown that concentrations of fecal coliform in surface waters from manured lands are often not significantly different from levels from unmanured lands if the manure has been stored and aged before land application. However, the proportion of fecal coliform in surface waters from lands receiving fresh manure is often higher.

Sewage sludge must be treated to reduce pathogens before it is applied to fields, but there is no such requirement for livestock manure. The Clean Water Act regulates pollution from stored manure, but not manure spread on fields. The EPA is currently considering revisions to the Clean Water Act that would include areas for land application of manure as part of the facility permit. State feedlot permitting regulations generally require management plans and incorporate BMPs that limit nitrogen levels to amounts crops can readily utilize in a growing season. Some research has shown that E. coli levels correlate with nitrogen levels. Therefore, nutrient management through permitting may help control some pathogens.

Many zoonotic pathogens have a wide range of hosts, including wildlife, and therefore their elimination from the watershed is impossible. However, on-farm control measures that help to reduce the risk of soilborne and waterborne zoonotic diseases include:

- Practice good farm hygiene to prevent or reduce infection in livestock.
- Manage manure to prevent spills and leaks.
- Store or treat manure before application to land to reduce the pathogenic bacteria population.
- Pasture animals at low densities, away from surface water bodies used by humans.
- Control vermin and insects
- Restrain animals from defecating and urinating directly into surface water used by humans.

Gases and dissolved gases

Manure applied to land can release volatile constituents to the ambient air. With the exception of hydrogen sulfide and ammonia, it is unlikely that volatile compounds would be released in concentrations toxic to individuals living nearby. However, no studies have quantified concentrations of other volatile compounds emitted from manure-amended soil.

In addition to various manure treatment methods, there are several techniques for land application of manure, such as manure injection, that can reduce the emissions of ammonia, and presumably other volatile compounds.

Scoping Question 2.d: What are the human health effects with regard to the transmission of disease through consumption of animal products?

Fly-borne disease

Flies that transmit diseases associated with animal agriculture are houseflies, Musca domestica and blow flies (family Calliphoridae). House flies breed in moist organic matter, including manure, soiled animal bedding and spoiled animal feeds around confined hogs, cattle, horses and poultry. Blowflies breed in media rich in nitrogen, such as dead animal carcasses, improperly disposed slaughter wastes and egg enriched poultry manure. A central question is whether animal agriculture affects the risk of fly-borne outbreaks of enteric diseases, and how that risk might vary with different animal species, housing styles, animal densities and farm sizes.

Food borne pathogens

A wide variety of food borne disease organisms in animal products can have a significant impact on human health. Children, pregnant women, the elderly, and the immunocompromised are most likely to develop severe symptoms and serious consequences. The development of "emerging pathogens," newer microorganisms that account for an increase in human illnesses. Despite a large body of literature, knowledge gaps are likely to be constantly appearing as organisms evolve and alter their genetic characteristics. There will be an ongoing need for medical research in this area.

Three main issues stem from food borne disease caused by animal products. A key issue is how to reduce the number of pathogens routinely found on animal products. A second issue is how such a reduction can be accomplished in an economically feasible manner including: improvements in health of animals on the farm, irradiation of products and pre-cooking or pasteurization of products. A third issue looks at how different systems of agriculture affects the level of contamination by pathogenic microorganisms. It is important to note that not all food borne diseases are caused by pathogens introduced into the system by agricultural processes. Many are introduced by improper handling and cooking, and existing illnesses in people who handle and cook the food.

Salmonella

Infection by Salmonella can cause enteric (typhoid) fever, uncomplicated enterocolitis and systemic infections. Enteric fever is characterized by diarrhea, fever, abdominal pain and headache. In many cases, the silent persistence of Salmonella in the gastrointestinal tract can lead to chronic conditions such as reactive arthritis or Reiter's syndrome. Salmonella is an ubiquitous organism in nature and can be isolated from multiple sources, including animals and animal products. Salmonella is the pathogen with the greatest estimated economic burden of human food borne disease. This pathogen infects approximately 3 million people and is responsible for more than 3,000 deaths every year.

Campylobacter

The two species of Campylobacter are the second predominant etiologic agent of bacterial diarrhea in humans. Campylobacter bacteria do not survive well in the environment and do not cause illness in animals. The typical symptoms of campylobacteriosis include watery diarrhea, abdominal pain and fever. Campylobacter infects approximately 1.5 million people and costs the American economy $1 billion per year. Outbreaks can be traced to poultry and pork products. Campylobacter is associated with the development of a secondary complication, Guillain-Barré Syndrome.

Escherichia coli O157:H7

Escherichia coli is a bacteria that is normally found in the mammalian gastrointestinal tract. E. coli was considered an innocuous communal organism, but in recent years many strains capable of causing infection have been isolated. Most pathogenic E. coli cause diarrhea and some infect the urinary tract which can become a fatal condition, particularly in children. E. coli is the cause of "travelers' diarrhea."

Listeria monocytogenes

Listeria monocytogenes is another emerging pathogen. Before 1980, L. monocytogenes had not been detected as causing major food borne outbreak; only sporadic cases had been reported. The symptoms of infection by L. monocytogenes are typically fever and headache, but a series of serious conditions can develop. In pregnant women, spontaneous abortion, stillbirth, septicemia and meningitis may occur; in other susceptible populations like the elderly, encephalitis and bacteremia are more common. Listeriosis is particularly dangerous because the case-fatality rate can be as high as 30 percent.

Yersinia enterocolitica

The genus Yersinia are part of the family Enterobacteriaceae and include three pathogenic species: Y. pestis, the causative agent of plague; Y. pseudotuberculosis, a rodent pathogen, and Y. enterocolitica, a food borne pathogen of humans. Children are particularly susceptible to Yersinia, and its symptoms of infection: diarrhea, low-grade fever and abdominal pain. The illness can last from a few days to three weeks and in some cases, lead to chronic enterocolitis.

Bovine Spongiform Encephalopathy - ("mad cow disease")

The first confirmed case of Bovine Spongiform Encephalopathy (BSE), also known as "mad cow" disease, was reported in April 1985 in the United Kingdom. Prior to mid-1996, the UK Ministry of Agriculture, Fisheries, and Food (MAFF) published statements reassuring the public that BSE could not be transmitted to humans. The government reversed this stance on March 20, 1996, with a statement that acknowledged a probable link between BSE and new variant Creutzfeldt-Jakob Disease (vCJD) in humans. The public was outraged that they had been misinformed and a BSE Inquiry was launched to investigate the government's response to the crisis.

Bovine Spongiform Encephalopathy is a chronic, transmissible and fatal disease of the nervous system of adult cattle. BSE is characterized by the perforations it leaves in the brain tissue of its victims, hence the name "spongiform." The initial symptoms in cattle are changes in temperament, nervousness or aggression, abnormal posture, lack of coordination and difficulty standing up, decreased milk production and loss of body weight despite continued appetite. The latency period from exposure to development of observable symptoms is two to eight years. Epidemiological evaluations of vCJD cases in dairy farmers whose herds had a history of BSE produced molecular evidence associating vCJD and BSE. Abnormal prion proteins (PrP) found in brain tissue of vCJD victims were similar in structure to prions isolated from cattle with BSE.

No cases of BSE in cattle or vCJD have been reported in the United States. It is a national priority to take all necessary steps to assure that infected cattle and infected feed are not imported to this country. The FDA has also banned the donation or transfusion of blood by people who have lived in the UK because the BSE agent is blood-borne .

Anthrax

Anthrax is a zoonosis caused by the bacterium Bacillus anthracis. It is primarily a disease of herbivores (cattle, sheep and goats), but few mammals are totally resistant. The bacteria multiply in the body of the infected animal, but form spores when exposed to air. The spores are resistant to environmental destruction and therefore can persist in soil for decades. Anthrax is most commonly found in areas with neutral to mildly alkaline soil and periods of flooding and drought. Most infections in animals occur after they have grazed in areas that have previously experienced anthrax. Flooding allows low-lying areas to accumulate high concentrations of anthrax spores; a drought then makes the spores accessible. The disease is transmitted in animals through the consumption of contaminated forage or water. Anthrax usually infects people who work closely with animals or animal carcasses, such as farmers, butchers and veterinarians. Individuals exposed through the handling and processing of hides, bones and other animal products have a higher chance of being exposed through inhalation. There have been recent anthrax outbreaks in northwestern Minnesota.

New diseases will be likely to emerge and become virulent in the future. The West Nile virus in birds which can crossover as a human pathogen is the latest example of this phenomena in 2002. There is no doubt other presently unknown microbial threats will arise to threaten our future food supplies. These can be organisms presently unknown to us or familiar microorganisms that develop a new level of virulence.

Scoping Question 3. How do these human health effects and associated risks vary by segment of the population including: workers, neighbors, animal product consumers, the elderly, the ill, pregnant women and young children?

A variety of outputs from animal agriculture could raise serious human health concerns. For workers in the industry, there are various airborne exposures and other workplace hazards. For neighbors there are air, water, soil and fly-borne exposures. Pathogens may be transmitted to humans from animal wastes through drinking contaminated surface water supplies, contaminated ground water supplies, or direct contact with contaminated environment through the recreational use of water. Some incidents of human disease attributable to contact with livestock waste have been reported. Water-borne nitrate represents a health risk to infants under the age of six months, because it can cause an acute and potentially fatal condition called methemoglobinemia. Insects, especially flies, are a potential vehicle for the transmission of human disease from manure, dead animal carcasses and other animal wastes. For consumers, there are environmental health threats and potentially negative nutritional effects associated with contaminated foods.

Production agriculture is the nation's second most dangerous industry with the greatest number of injuries occurring at beef, hog and sheep operations. Working in confinement operations presents a number of health and safety risks to the employee, such as traumatic injury, hearing loss, dermatologic conditions and possible zoonotic infections. Prevention of injuries can be accomplished through:

- Engineering controls (facilities design)
- Ventilation
- Personal protection equipment (eye protection, hard hats, guards on moving parts, gloves)
- Administrative controls (worker safety plans and procedures) and
- Public education.

While human health risks can be associated with different types of animal production systems, it is difficult to make direct comparisons between systems. Most human health literature reviewed was not explicit about the type of production system studied. There are countless variations of animal production systems, making all but general classifications of systems nearly impossible.

Significant questions remain unresolved regarding air emissions from feedlots. Research has historically focused on odors in Minnesota and elsewhere. There has been less emphasis on detailing the specific chemical constituents that cause these odors. Further research needs to be conducted to inventory the VOCs and reduced sulfur compounds released from these facilities to understand better the chemistry of the associated odors. Ultimately, this will ensure that all compounds of concern are accounted for in Minnesota's regulatory program.

Scoping Question 4: How do the human health effects vary by species, operation, system type, management, geography, and concentration of livestock facilities?

There is insufficient data in the literature to answer this question.

Scoping Question 5: What monitoring techniques, modeling approaches and standards are available and in use in Minnesota as well as other places to detect and measure for the existence of these human health effects and how can we judge the validity of each?

Answers to Scoping Document question 5 were incorporated into the extended answers to questions 2.a. through 2.e. Therefore, Scoping question 5 has not been treated as a separate question.

Scoping Question 6: What are the current and potentially available prevention and mitigation measures for producers, workers and neighbors to address these effects and to what extent are these effective?

Answers to the Scoping Document question 6 were incorporated into the extended answers to questions 2.a. through 2.e. Therefore, Scoping question 6 has not been treated as a separate question.

Recommendations for Human Health Research

All the CAC consensus recommendations relating to human health are found in the "Recommendations" section near the beginning of this document. A number of technical recommendations from EarthTech staff can be found in the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional medical, epidemiological and environmental research is needed to address gaps in the current knowledge of potential impacts of animal agriculture on human health in Minnesota. It is important to document the source strength and environmental fate of these outputs to the extent possible or appropriate. In addition, studies on the role of best management practices in reducing risks of human health impacts needs to be quantified to improve acceptance by producers.

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Animal Health and Well-Being

The material in this chapter is based on the 1999 GEIS Literature Summary Chapter L on Animal Health and the 2001 Technical Work Paper (TWP) on Farm Animal Health and Well-Being. The Literature Summary was produced by a team of experts from the University of Minnesota with a perspective toward food production. The Literature Summary chapter includes discussion of the rules and regulations relevant to animal health, prevention of cruelty and pollution control. It also discusses routine livestock handling practices, disease incidence, air quality, the use of antibiotics and metabolic modifiers in animal diets, use of manure as feed, mitigation measures and current research topics.

The Scoping document continually refers to "animal health and well-being." The TWP explains that the current scientific consensus is to use the term "animal welfare" to refer to the combination of "animal health and well-being."

The TWP updates the material in the Literature Summary and focuses on the animal welfare perspective. The TWP was produced by Marlene Halverson, an agricultural consultant specializing in alternative swine production systems, with the assistance of an international team of expert advisors.

The material in this chapter of the Final GEIS Summary document includes the contrasting perspectives of the Literature Summary and the Technical Work paper. These two source documents look at many of the same topics but often offer widely different perspectives and approaches.

Increasingly the American public has become concerned with issues of animal welfare and the prevention of cruelty to livestock. The use of animals for food, labor, recreation and companionship requires steps to ensure that the health and well-being of these animals is adequate and consistent with societal norms and expectations. Society needs to have an understanding of where and how their food sources are produced, have an active involvement in the process, and intervene if and when necessary.

Animal health and well-being are the foundation of any humane, sustainable livestock production system. Producers must ensure the management practices they use are appropriate for the species, the type of production system and the environment. Much of what is known about animal husbandry has been determined through years of hard work, practical experience, academic research and refinement. Producers are frequently reluctant to impose new management methods on their animals until it has been demonstrated that the new methods work in a similar setting. Their caution emphasizes the need for research with appropriate controls so that management practices can be thoroughly evaluated.

Animal research has increased our understanding of the interactions of production animals with their environment and has greatly enhanced the efficiency of producing animal products. Contemporary agricultural practices and veterinary health objectives focus on maintaining and enhancing animal performance, placing primary importance on the function served by the animal in the agricultural system rather than on its state of well-being as an entity. Welfare, on the other hand deals with state of the animal its attempts to cope with its environment. The emphasis of animal welfare science is on health and well-being for the animal's sake, from the perspective of the animal.

Most modern concerns about the welfare of farm animals stem from the impacts of economic and technology choices in industrialized forms of agriculture, which treat animals as if they were organic machines rather than sentient beings. When the animal's function alone is emphasized, the imbalance has important effects, not only on farm animal welfare, but on environment and human health. It also has economic effects: this year the European Union is committed to bringing farm animal welfare to the World Trade Organization, in part because of the devastating social, animal welfare and economic effect of the foot and mouth disease epidemic in 2001.

Scientific literature on farm animal welfare has developed since the 1960s, with ethology (study of animal behavior) a leading discipline. The 1965 report of the Brambell Committee, a group of zoologists assigned by the British government to look into the welfare of animals kept under intensive livestock husbandry systems; recommended that production systems should allow animals at least these five basic freedoms: to turn around; to groom themselves, to get up, to lie down, and to stretch their limbs.

More recently the UK's Farm Animal Welfare Council stated animal welfare needs in terms of five freedoms that included:

- Freedom from thirst, hunger and malnutrition;
- Freedom from discomfort
- Freedom from pain, injury and disease;
- Freedom to express normal behavior
- Freedom from fear and distress.

Animal welfare concerns arise at four stages in animal production:

- preproduction (issues of domestication and genetic selection),
- production system;
- when the animal goes to slaughter (is it fit or is it crippled, injured or weak, injured or subjected to prolonged fear, pain and suffering during transport?); and
- at the slaughter plant (line speeds in modern beef packing plants can be up to 400 animals an hour and in modern pork packing plants up to 1000 animals per hour, risking both animal and human well-being.)

Study Question 1: What are the current regulations and routine practices in Minnesota and other places related to animal agriculture that are aimed at the health and well being of animals? What is known about these practices or in the case of regulation what is known about compliance?

Federal and state regulations related to the health and well-being of agricultural animals vary. This GEIS lists major sources of these regulations and authorities. Interested readers can find more information in the Literature Summary, Animal Well-being TWP and the Role of Government TWP. The gamut of routine practices in animal agriculture also encompasses an enormous range of techniques and combinations of technologies. The Description of Animal Agriculture TWP provides more information on the production of swine, bovine and poultry species in Minnesota.

The Animal Welfare Act, 7 U.S.C. 2131-2156 is the U.S. government's principal law protecting the welfare and well-being of animals; however, animals raised for food or fiber are specifically excluded from the Animal Welfare Act. Federal law has a large number of statutes and regulations relating to drug use on animals, transport, marketing, and sale of food and fiber animals. The Humane Methods of Livestock Slaughter Act of 1958 calls for humane slaughtering and handling of livestock in connection with slaughter. Congress has not, however, extended the requirement of humane treatment to these animals while on the farm. Federal tax law has implications for animals too. Live animals on farms are considered no differently than crops. The animals can be depreciated, and capital gains and losses applied to them. Animals on farms are another business commodity, much like cars, paper, steel or any other business product. Federal law is also involved in marketing many species under the auspices of the U.S. Department of Agriculture.

In Minnesota there is no single governmental department or agency overseeing the welfare of animals on farms. The agency whose mandate is closest to animal welfare is the Minnesota Board of Animal Health. However, this board deals with preventing the spread of animal diseases and not primarily with the health and well-being of individual animals on farms, during transport, at stockyards or slaughterhouses. It is difficult to obtain comprehensive compliance data on animal well-being. Monitoring records are limited in scope and availability. Evidence is usually in the form of anecdotal observations by farmers, agricultural and environmental inspectors and facility contractors.

Minnesota Statutes, Ch.. 343.21 covers animal cruelty for all animals in the state. However the statute provides weak penalties for violations, no matter how severe. Deliberate cruelty to livestock is illegal, although the extent of enforcement of this provision is questionable. The Board of Animal Health employs three inspectors to enforce the statute and its rules, who are assigned to cover 36,000 cattle farms, 11,000 hog farms, 3,000 sheep farms, 650 turkey farms, and 350 chicken farms—a total of approximately 1.2 to 2 million Minnesota animals.

Minnesota has no law requiring producers to have downed animals euthanized on the farm rather than send them to slaughter or requiring transport, stockyard or cull facility workers to euthanize them immediately if they are injured during transport. There is no law or government agency protecting the welfare of ill, injured or incapacitated animals. This is an important gap in protection of farm animals in Minnesota.

Study Question 2: What are the effects of the animal agricultural systems affecting animal health and well-being and how are these effects measured and addressed, including consideration of:

a) Antibiotic use

b) Disease and sickness

c) Indoor confinement and animal density

d) Air quality in confinement facilities

e) Use of manure as feed

Although the basic question is straightforward, related data generally does not exist in an easily accessible format. The first four factors listed above do play important roles in animal health and well-being. The fifth factor (use of processed manure as feed) can play an important role, especially if processing is inadequate. However, little processed manure is fed to animals in Minnesota or in the United States.

Antibiotic Use

The public, and especially those in the field of medicine, are concerned with increasing antibiotic resistance in bacteria that can cause human diseases. An overwhelming body of evidence exists that the livestock industry's continued, routine use of antibiotic feed additives at subtherapeutic levels contributes to antibiotic resistance (World Health Organization 1997). These concerns have contributed to a growing debate on food production practices. Data on individual farm antibiotic use is not maintained or provided by pharmaceutical distributors. Only general aggregate data or estimates on drug use in animal feed is available. Prescriptions are not required to purchase antibiotics for farm animal use in the United States. The European Union has taken a much more aggressive posture against the subtherapeutic use of antibiotics in livestock.

In Sweden such use of antibiotics was banned in 1985. While the poultry and cattle industries made comparatively smooth transitions, on many piglet-producing farms, withdrawal of antibiotics from feeds unmasked disease pressures that low-level antibiotic additives had kept "hidden." As a result, Swedish farmers who were having problems changed facilities and management to provide a higher level of welfare to the animals than before (allotment of space, use of straw, weaning age). Today, total antibiotic use for food animals in Sweden is 55 percent lower than before the ban, the incidence of antibiotic resistant bacteria has been reduced, animal health is very high, and production levels are close to pre-ban levels.

Animal Vices, Disease and Morbidity

Two vices, which appear common across all domestic poultry, are feather pecking and cannibalism. Feather pecking has been associated with cage systems but can be observed regardless of housing condition. Significant poultry losses due to cannibalism can occur in confinement as well as alternative systems such as free range. Mortality loss can be severe. Beak trimming is used to reduce both vices.

In swine, behavioral problems include stereotypic behaviors, cannibalism and aggression between contemporary animals. Stereotypic behaviors by pigs are activities that seem to serve no useful purpose to the animal. Most often these behaviors are associated with pregnant sows housed in confinement systems. These confined pigs seem to show self-destructive behavior brought on by the lack of environmental stimulation. Swine cannibalism is most often expressed as tail biting and ear biting. This habit is more prevalent in confinement systems compared with extensive (outdoor) systems. The widespread practice of docking tails in confinement systems seems to be the most effective management practice to control tail biting.

Many different kinds of parasites affect agricultural animals in North America: skin-inhabiting ectoparasites, free-living flies and internal parasites. Generally regarded as threats to animal health and well-being, these parasites produce varied effects. Free-ranging animals are exposed to the greatest variety of parasites, whereas animals confined in dry lots or indoors are exposed to progressively fewer kinds. Many individual farms have routine parasite monitoring and control programs, but there are no systematic reporting systems for any of Minnesota's animal industries.

Bovine Spongiform Encephalopathy (BSE or mad-cow disease) is a transmissible, slow progressing, fatal nervous disorder of adult cattle. It is characterized by the formation of holes in the nerve cells and results in a chronic degeneration of the brain. The disease became an epidemic in the United Kingdom. From April 1995 to April 1999, some 176,433 cases of BSE were confirmed. Implementation of a number of measures reduced new cases dramatically. A prohibition in 1998 banned the use of rendered by-products derived from ruminants as a feed for ruminants in the UK. No cases of BSE have been detected in the U.S. The federal government restricts importation of live ruminants and ruminant products from countries where BSE is known to exist, and import restrictions have been imposed on other products derived from ruminants.

Indoor Confinement and Animal Density

Prior to the 1960s, practically all livestock was raised in some type of outdoor system. Typically, shelter was provided to protect animals from the harshest environmental conditions. Livestock producers planned production schedules based on seasonal changes in weather and feed availability. This affected the quantity of retail animal products that were available to the end consumer. The daily work of caring for livestock was physically demanding due to a lack of mechanization in feed processing and handling, removal and distribution of animal manure, animal handling and restraint, and fencing. The hard work and high labor requirements limited the number of animals one person could properly maintain. Cold and snow during winter and rain and mud during spring made caring for livestock outside difficult. Environmental conditions during parts of the year were very uncomfortable for the animals and their caretakers.

Livestock producers started to exert greater control over environmental conditions for housing livestock in the late 1950s and early 1960s by moving livestock indoors. Indoor confinement systems usually:

- House animals at a greater density than is typical of outdoor systems.
- Maintain a targeted room temperature by capturing heat radiating from the animals, and/or providing supplemental heat in winter and providing mechanical cooling systems in summer,
- Control quality of air in the building with a ventilation system that relies on exhaust fans and/or strategic control of openings to allow outdoor air to enter the barn.

The typical minimum standards of animal health and well-being include adequate nutrition, freedom from environmental stress, and lack of disease, injury and pain. One of the main criticisms of confinement systems is that they deny normal animal behavior. This is true in some cases. This evaluation must be placed in context with other animal health and well-being criteria when comparing alternative husbandry systems. In some instances, a combination of indoor and outdoor husbandry is beneficial to meet the seasonal needs of animals.

Increased animal density associated with confinement requires improved management skills to meet the needs (nutrition, health, well-being, etc.) of the contemporary animal. Because contemporary animals produce more than their ancestors, their specific needs, and the management required to meet these needs, also differ. Genetic potential, housing, production system and other factors interact and impinge on the health and well-being of the contemporary animal and the profitability of the farm. Thus, it is difficult to compare animal welfare across a variety of farms.

Since their inception, the size and scale of indoor confinement systems has continued to increase. Increased size allows these production units to capture economies of scale and spread their large fixed facilities costs over more production units. Rising input costs with static commodity prices have squeezed profit margins for livestock producers over the last 30 or so years. One response to these shrinking margins is to increase biological efficiency and output. Large-scale production units compensate for slim margins with increased output to generate the desired income. From the animal welfare standpoint, two management factors are especially important to consider: degree of confinement and intensity of production.

About 99 percent of hens producing table eggs in the U.S. are being kept in battery cages (rows of cages side-by-side and stacked on top of each other in "batteries." These hens are thus unable to perch, dust-bathe and build a nest. Welfare problems of this system include osteoporosis, muscle weakness, bone breakage—conditions which are likely to cause severe and prolonged pain and suffering, and can be especially critical during transport. Additional welfare problems include starvation of force-molted laying hens (a practice that extends hens' productive lives by stimulating a second laying cycle), foot deformities and beak trimming. Spent hens and broiler lameness are other welfare problems. Some European countries have increased the minimum space allowance for laying hens and others have banned battery cages altogether.

As with meat chickens, the welfare of turkeys is a concern due to often high densities of birds in turkey houses and the selection for rapid growth by breeding companies. As with broilers, pigs and dairy cattle, breeding for larger size and performance in turkeys has occurred at the expense of good bone growth or structure.

Major welfare problems of dairy cattle include mastitis, foot and leg problems, reduced fertility, inability to show natural behavior and injury. Other welfare issues with cattle include dehorning and calf housing, and the issue of surplus calves. While countries in the EU have developed legislation covering the welfare of calves during transport and Canada has developed recommended codes of practice, protection of calves in the U.S. is limited.

Housing is a pig welfare issue. On most industrialized pig breeding farms, boars and sows are housed permanently in crates. Individual crate housing of boars used to be common practice in Europe, but today it is forbidden. In January 2001, an EU directive was proposed that required sows to be housed in groups rather than individually in crates or tethers and pigs to have materials for rooting. Today, gestation-stall sow housing predominates in the U.S. hog industry. Osteoporosis in crate-housed sows is a pressing welfare issue (contributing to the downer, (*fallen or injured*), sow problem in the industry). Premature sow mortality is a significant and growing problem in the U.S. swine industry. An estimated range from 10 percent to 20 percent of sows on intensive confinement operations die while still in production.

Alternative livestock production systems do exist. Research has been directed toward developing alternative systems and solving the problems of producers trying to adopt these systems —for example, at the University of Minnesota an alternative swine systems program has been created and will be investigating pasture farrowing, deep-bedded hoop housing, and a version of a model of deep-bedded group farrowing and lactation developed in Sweden. Further, a production method for dairy cows known as intensive rotational grazing has gained favor among a segment of Minnesota dairy farmers.

Air Quality in Confinement Facilities

Air quality within animal facilities depends on many factors including the ventilating system and air exchange rate, temperature, relative humidity, manure system and management, bedding use, feed form and quality, feeding system and animal activity. Airborne particulate or dust is considered to be a health risk for workers exposed over a long period of time. There are no data available to demonstrate specific effects on dust on the health of pigs, cattle or poultry, but it is known that dusty environments are associated with decreased health. Animals housed in intensive production systems (essentially housed indoors) such as those commonly found in Minnesota, are exposed to a number of different atmospheric gases at levels that are higher than those found outdoors. Hydrogen Sulfide and ammonia have received the most attention. A few sudden deaths of housed animals in these confined barns are reported each year in Minnesota. Airborne endotoxins, microbes and pathogens are other airborne contaminants that may pose a health risk to animals housed inside buildings.

Use of Processed Manure as Feed

Animal wastes have been recycled as feed for cattle, swine and poultry. Most waste used for animal feed is from confined systems. Animal wastes are a good source of protein and fiber, however, recycled animal wastes for feed have the potential of exposing animals to pathogenic organisms, toxigenic molds, parasites, harmful levels of pesticides, medicinal drugs, and high concentrations of trace minerals and heavy metals. In 1980 the Food and Drug Administration decided to leave the regulation of feeding animal wastes to individual states. Recent epidemics of animal disease with human health impacts have resulted in more stringent restrictions on refeeding of animal wastes or byproducts to livestock.

Disease Prevention and Mitigation Measures

Exposure to bacterial and viral pathogens occurs frequently in the life of an animal, and can spread laterally throughout animal populations at a rapid rate. There are many disease-control strategies, such as all in-all out animal flow and segregated early weaning for swine, vaccination and early separation of calf from dam in cattle, immunization and medication for poultry. The use of preventive medication in feed is strictly controlled by the FDA. Strategies for controlling airborne contaminants in confinement facilities include, oil sprinkling for dust, ventilation control and air cleaning. Human exposure is controlled by limiting the time people are exposed to airborne contaminants and having people wear appropriate personal protection.

Animal Health and Welfare

Caretakers of animals used to produce food and nonfood products for human consumption are sensitive to the health and safety needs of their animals. There are many obvious negative impacts of unhealthy animals including less efficient production, greater inputs of time, money and treatments required to return animals to a healthy condition, and reduced economic returns to the producer. The consequences of unhealthy animals quickly become apparent to the producer.

Society (both producers and consumers) is paying more attention to animal well-being and is exerting pressure to influence current production practices to promote greater animal welfare. Healthy animals will not prosper if they are improperly managed. Management skills must do more than simply promote animal health; they must maintain animal well-being. However, although there is good scientific and social consensus on the definition of physical health, the definition of well-being is more nebulous for both humans and other animals.

Most agricultural animal scientists believe an acceptable level of well-being is achieved in the majority of production systems on American farms. The overall level of care provided to agricultural animals occurs because animal caretakers have a strong working knowledge of animal husbandry and recognize factors that affect animal comfort and normal behavioral patterns. According to a 1992 study cited in the GEIS Literature Study, Chapter L, most Americans support the agricultural use of animals, and believe producers generally provide humane treatment of their animals.

A 1999 survey in Chapter L of the Literature Summary indicated consumers are concerned about and would like to prevent inhumane treatment of agricultural animals. Many individuals also support governmental regulations to ensure the humane treatment of agricultural animals. This new social ethic for animals recognizes that concern for all animals that suffer and not just those treated with blatant cruelty. Most in the livestock production industries recognize the need for continued improvements in the care of agricultural animals.

Animal well-being has been defined as a situation in which an animal exists within a range of acceptable environmental specifications and has been identified as the ultimate goal of farm animal use strategies. In a relatively simplistic manner, farm animal well-being has been described as implying a reasonable quality of life and a gentle death. Animal rights groups feel that additional criteria are clearly required to achieve a comprehensive definition of well-being.

The difficulty in defining animal well-being is due in part to different approaches to assessment and to the use and implied meaning, of various terms used to describe it. A comprehensive discussion of the terminology used in defining animal well-being and welfare is provided in the Animal Welfare TWP. The TWP also includes detailed discussion of animal agriculture production systems used in Europe to promote animal welfare.

Producers of livestock and their advisors often use easily measured traits as indicators of overall animal health and well-being. For instance, the quantity of feed and water consumed by animals is often used as an indicator of their condition. These traits are routinely measured on farms and compared against some expected intake for that size and class of livestock.

Social interactions among pen and herd mates are used by some producers as indicators of animal well-being. Certainly, these observations provide important information about animal well-being in extreme cases such as with livestock behavioral vices. However, in less extreme situations it is difficult for humans to interpret the significance of social interactions to the animal's well-being. Certain standards of animal health and well-being are generally accepted by society. These include the need to be free from hunger and malnutrition, free from thermal or physical distress, free from disease and injury, free from fear, and the need to be able to express most normal behaviors. In the interests of maximizing food production farmers have chosen to restrict certain natural animal behaviors.

Animal Well-Being – Beyond Health

A literature review about animal well-being is limited in what it can tell us. Again, much of the challenge is defining "animal welfare," to some a nebulous qualitative term. Others would try to quantify the term by using very specific measurements. The philosophy of science tells us that if something that is, even in theory, impossible to measure, it is outside the realm of science. However, something that is difficult to measure is no less scientific than that which is easy to measure. Two possible implications of this are that animal well-being is a scientific issue (beyond simple measures of health) and that *standards* of animal welfare are not a matter of science. These are value judgments. Determining the sufficient level of animal well-being is a socio-political (or moral-philosophy) question. Science, by its nature, can tell us "how much," but not "how much is enough."

The External Benefits and Costs Report (Chapter F of the GEIS Literature Summary) provides further discussion about these results and the potential economic significance of people unhappy about animals' welfare. The treatment of animals is fundamentally a social construction or a convergence of public opinion. That is, it cannot be grounded in any fixed measure because the acceptability of any treatment changes with the introduction of alternatives and changing human sensibilities. The controversy largely stems from the presence of both science and personal or social preferences.

The fundamental producer premise is that high levels of productivity from farm animals and the closely related absence of diagnosable morbidity are sufficient evidence that animals are well cared for and have an acceptable level of well-being. Most livestock producers feel that they are providing decent and humane treatment for their animals. They are as appalled as any member of the public at deliberate or unnecessary animal cruelty. Disagreement can occur over a number of animal handling techniques regarded as cruel by some members of the public, but innocuous or necessary for long-term welfare by producers. Examples of these practices include debeaking or dehorning, neutering or castration, and confined living space for livestock. Most animal productivity measures are likely to be positively related to animal welfare.

Productivity and well-being are at times inversely related. An example is the stress associated with persistent, prolonged overcrowding that prevents the animal from engaging in virtually all of its natural behavior. Other activities that cause acute temporary pain, such as administering vaccines, have obvious positive effects on long-term well-being (and are similar to what we do for human children). Other situations fall in the middle of these extremes, where the interpretation of potential effects on animal well-being become more controversial. Examples include the immediate separation of a newborn dairy calf and its mother (the dam) or the removal of body parts (chickens' beaks, pigs' tails) without anesthesia to reduce the negative effects of behavior.

The philosophy of current livestock management practice is that restriction of some aspects of animal behavior represents a temporary, justifiable, minimal distress imposed to facilitate long-term management goals. The fundamental question is, Can we quantify the magnitude and consequences of this practice to animal well-being?

Some observers however, point out that productivity is not a sufficient measure of animal well-being. Attempting to measure well-being through simple proxies that are easily quantified has clear advantages, but it does not mean that what is being measured is actually welfare. The literature frequently suggests that the proxy measures are more scientific than (and thus superior to) intuitive notions of well-being. It is most people's intuition that animals are bothered by many of the same things humans would be bothered by. In the social sciences, the issue is even clearer. If people are concerned about something, then it is real -- emotion *is* reality when it comes to valuing something economically.

Attributing human characteristics (desires and feelings) to that which is nonhuman is called anthropomorphism. Though often used as an accusation of nonscientific behavior in the literature, "anthropomorphism" is more-or-less a synonym for "using the best available model for animal well-being, namely human well-being." There is not a morphological or physiological determinant of suffering in humans, but most people believe that human suffering is possible. Many people believe that a practice or technique which would cause physical, psychological or emotional suffering if applied to a human being must evoke a similar or analogous response from farm animals. Other people would argue that this is not true because animal do not possess the same level of consciousness as humans do.

Study Question 3: How do the effects of study question #2 vary by species,operation, system type and management practice?

The terms operation, management practice, system type and system were combined into the single term **system**. An attempt was made to collect the details requested in study question #2 into a matrix by system type, but insufficient data was available to complete the analyses. On a gross comparative level, relative effects of extensive and intensive systems could be made across species. However, specific systems generally differ sufficiently among species to make such comparison invalid, or at least difficult to interpret. Traditional, contemporary and alternative livestock production systems of various sizes operate in Minnesota. Within each system, management practices can allow the producer to meet a variety of income and quality of life goals. Large units provide perceived advantages (including labor efficiency, volume of production, and the ability to provide uniform management for groups of similar animals) but the concentration of animals imposes challenges associated with animal health.

Small units and certain alternative or sustainable systems are frequently perceived as being supportive of animal well being. However, these systems also impose their own challenges and may not have sufficient resources to institute public health protection practices needed to manage properly animals and the waste they generate.

All livestock production systems strive to minimize any potential negative impacts on the animal, the producer, the environment and society while maximizing profitability. However, no one perfect set of methods is applicable to every livestock production system. Management practices that are effective in small units may not be effective in larger units. Regardless of the size or type of system used, public awareness and expression of concerns (perceived and real) for animal health and well-being have increased.

Management decisions have a large influence on the ability of the production system to provide for animal health and well-being. Excellent systems can be managed improperly and be detrimental to animal health and well-being. In poor systems, animal health and well-being can be improved through appropriate modifications in how the system is managed. Management strategies need to be directed towards the specific operation, regardless of whether the system is intensively or extensively managed, or the facility is large or small.

Most agricultural animals eventually leave the animal unit for slaughter and harvesting of food and nonfood products. Caretakers are becoming increasingly aware of the need to ensure animal well-being after the animal has left the production unit. Many factors that contributed to reduced animal well-being during handling, transporting and slaughtering have been corrected through appropriate training of individuals involved in these tasks including long-distance transport and the handling of excitable animals. Improvements in equipment design and animal handling facilities will make quiet humane slaughter of farm animals easier to achieve.

Study Question 4: What monitoring techniques and standards are available to determine and address the effects on animals in Minnesota and other places?

This question is difficult to answer in a direct, specific manner because such data are generally not available. Recent efforts through the National Animal Health Monitoring System are providing a growing database. As public interest increases it is likely that monitoring, inspection and enforcement standards will be developed through additional animal welfare regulations.

The TWP presents issues raised by animal welfare organizations that are advocating reforms to contemporary animal farming practices. There are three major overlapping ethical concerns were expressed by the public over the quality of life of farm animals. These are:

- Animals should lead natural lives;

- Animals should feel well by being free from prolonged and intense fear, pain and other negative states and by experiencing normal pleasures,

- Animals should function well through satisfactory health, growth and normal functioning of physiological and behavioral systems.

Some people profess concern about the well-being of farm animals, but do not possess the scientific knowledge to act correctly on their concerns. The public generally looks to scientific research on the welfare of farm animals for guidance regarding its concerns. For that reason, the conception of animal welfare used by scientists must relate closely to the public's ethical concerns.

Study Question 5: What are the current and potentially available prevention and mitigation measures for addressing any negative effects on animal health and well-being in Minnesota and other places and to what extent are these measures effective?

Contemporary agricultural practices and veterinary health objectives focus heavily on maintaining and enhancing animal performance, placing primary importance on the function served by the animal in the agricultural system rather than on its state as a sentient creature. The result is that most animal science research centers on modifications to enhance the animal functions, ignoring what those modifications do to the animal as a whole. Animal welfare is an integral and legitimate element of a Generic Environmental Impact Statement on Animal Agriculture.

It was relatively easy to summarize available preventive and mitigative measures for addressing negative effects on animal health and general aspects of animal well-being (animal comfort, physical stress, etc.); because the industry responds quickly to detrimental impacts on animal health performance. Considerably less is known relative to the cognitive aspects of animal well-being. The TWP and the Animal Health Chapter of the Literature Summary both discuss disease prevention and mitigation measures in depth. The TWP includes a focus on cognitive factors of animal science.

The basic biological and behavioral characteristics of an animal comprise the resources that animal possesses for coping with its environment. Species-specific, natural behaviors and biology contribute to how farm animals experience different production systems. Much scientific research has gone into identifying farm animal needs and how they might be better met in livestock production. Adopting more natural alternatives to current practices is one way of preventing and mitigating negative effects on animal heath and well-being. These alternatives should be consistent with social goals for animal agriculture such as public health, food quality and safety, humane ethics and environmental quality. Not all available alternatives meet all these objectives. Several well-known alternatives to current practices in animal agriculture are discussed in the Animal Welfare TWP. Modifications to existing animal handling systems, such as those promoted by professor Temple Grandin, can minimize stress and increase animal well-being.

Since the Brambell Committee, animal welfare science has grown into a distinct discipline, which recognizes that observed behaviors of farm animals can tell us about their underlying physiological and mental states, including whether they are in harmony with their environment, are maladapted, or are suffering. Because behaviors are often accompanied by underlying neuroendocrine changes, neuroendocrine analysis is an important companion science to ethology in the study of animal welfare.

Another reason for including farm animal welfare in this GEIS on animal agriculture relates to the role of trade in Minnesota's future. The European Community, through its Scientific Veterinary and Animal Welfare committees and the Council of Europe Standing Committee on Farm Animal Welfare, has benefited from decades of policy-making on farm animal welfare. In the U.S., policy-makers have not fully considered the scientific and economic aspects of animal welfare or a basic conceptual framework similar to the European model. A discussion on economic and scientific conceptualization of animal welfare are presented in the Animal Welfare TWP.

Animal welfare science differs from **animal production science** in several ways. The emphasis of animal welfare science is on health and well-being for the animal's sake, from the perspective of the animal, rather than to achieve some production (or profit) maximum or cost minimum to the industry. Animal welfare science is distinguished by its emphasis on the "whole" of the animal rather than the functioning of its separate parts. Further, although poor production can sometimes be an indicator of poor welfare; high production levels do not necessarily imply a good welfare state.

This topic is extremely controversial to some members of the public. Decisions on animal welfare issues involve a number of complex social, economic ethical and philosophical questions. If American consumers demand changes in animal welfare standards and pay the costs involved in these modifications the production system will respond accordingly.

Anti-cruelty laws are not necessarily comparable to animal welfare laws, in that, while proscribing certain harmful acts toward animals, they do not necessarily prescribe scientifically based measures to be taken or avoided to make animals' lives better. European laws are characterized by not only proscribing acts but encouraging practices that improve the lives of animals . American states should seriously evaluate these alternative approaches to animal welfare issues.

Recommendations for Animal Welfare Research

All the policy recommendations relating to animal welfare are found in Appendix D of this document. A number of technical recommendations from University of Minnesota and the Marlene Halverson team can be found in the Literature Summary and the TWP document. Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC or EQB. Additional research is needed to address gaps in the current knowledge of potential impacts of modified production practices on animal welfare in livestock agriculture in Minnesota. Public concerns should be discussed and additional research is warranted in many other areas. These topics are more thoroughly discussed in the Animal Welfare TWP and the Animal Health Chapter of the Literature Summary as part of the overall Animal Agriculture Generic Environmental Impact Statement.

Appendix A

Glossary

Definitions are included for clarification purposes only. This glossary is not a listing of official definitions.

Animal feedlot A lot, building, or combination of lots and buildings intended for the confined feeding, breeding, raising, or holding of animals and specifically designed as a confinement area in which manure may accumulate or where the concentration of animals is such that a vegetative cover cannot be maintained within the enclosure. For purposes of these parts, open lots used for the feeding and rearing of poultry shall be considered to be animal feedlots. Pastures shall not be considered animal feedlots.

Animal manure or manure. "Animal manure" or "manure" means poultry, livestock, or other animal excreta or a mixture of excreta with feed, bedding, precipitation, or other materials.

Animal unit A unit of measure used to compare differences in production of animal manures that employs as a standard the amount of manure produced on a regular basis by a slaughter steer or heifer. The following equivalents shall apply: one mature dairy cow > 1,000 pounds, 1.4 animal unit; one mature dairy cow < 1,000 pounds, 1.0 animal unit; one heifer, 0.7 animal unit; one calf, 0.2 animal units; one slaughter steer or stock cow, 1.0 animal unit; one feeder cattle or heifer, 0.7 animal units; one cow and calf pair, 1.2 animal unit; one horse, 1.0 animal unit; one swine over 300 pounds, 0.4 animal unit; one swine between 55 and 300 pounds, 0.3 animal units, one swine under 55 pounds, 0.05 animal units; one sheep, 0.1 animal unit; one turkey > 5 pounds , 0.018 animal unit; one turkey < 5 pounds , 0.005 animal unit; one laying hen, 0.033 animal unit. For animals not listed, the number of animal units shall be defined as the average weight of the animal divided by 1,000 pounds. These animal unit numbers are based on the values given in the 2000 Feedlot rules, Chapter 7020.

Aquifer A natural geologic formation that yields useful amounts of water.

Atmospheric deposition The process by which materials held in the atmosphere move to the earth’s surface, including precipitation, particles, aerosols and gases.

BMP Best management practice is a conservation practice determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

CAC Citizen Advisory Committee for the Generic Environmental Impact Statement on Animal Agriculture.

Concentrated animal feeding operation or CAFO. "Concentrated animal feeding operation" or "CAFO" means animal feedlots meeting the definition of a CAFO in Code of Federal Regulations, title 40, section 122.23.

Carrying Capacity The animal population that an area will support long term without undergoing deterioration or consumption of the least limiting resource

Confinement Facility A type of feedlot where the animals are confined and fed under a roof or in a building.

Cumulative Impact The impact on the environment that results from incremental effects of a project in addition to other past, present, and reasonably foreseeable future projects regardless of what person undertakes the other projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Discharge. "Discharge" means the addition of a pollutant to waters of the state, including a release of animal manure, manure-contaminated runoff or process wastewater from an animal feedlot, a manure storage area, or an animal manure land application site by leaking, pumping, pouring, emitting, emptying, dumping, escaping, seeping, leaching, or any other means. Discharge includes both point source and nonpoint source discharges.

EAW "EAW" means environmental assessment worksheet

Economies of scale Reductions in the average cost of a product in the long run, resulting from an expanded level of output. Related to the technical input/output relationship rather than price changes as in economies of size.

Economies of size Pecuniary (i.e., money compensated) gains from increasing the volume of outputs. For example, buying a 6 oz. box of detergent from a vending machine at a laundromat will cost more per ounce than buying the 120 oz. jumbo box at a discount store on a per ounce basis.

Effluent The discharge of a pollutant, or pollutants, in a liquid form from a containing space.

Environment The complex of physical, social, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival. It includes land, air, water, minerals, flora, fauna, ambient noise, energy resources, and artifacts or natural features of historic, geologic or aesthetic significance.

EIS Environmental Impact Statement is a thorough study of a project with potential for significant environmental impacts, including evaluation of alternatives and mitigation.

EQB Environmental Quality Board is the state agency that among other responsibilities adopts environmental review rules, monitors their effectiveness and revises as appropriate; provides technical assistance to interpret and apply rules.

EPA The United States Environmental Protection Agency.

Externality Cost or benefit incurred by others without just compensation.

Family farm Any farm owned by a natural person, or one or more natural persons all of whom are related within the third degree of kindred according to the civil law, at least one of whose owners resides on or actively operates said farm.

GEIS Generic Environmental Impact Statement.

Global climate change Changes in the earth's climate caused by human-induced increases in atmospheric gases which trap heat. These "greenhouse gases" include carbon dioxide, methane, and nitrogen oxides.

Ground water The supply of water under the earth's surface and below the water table.

Hydrogen sulfide (H_2S) A toxic gas formed during anaerobic decomposition of manure. It smells like rotten eggs and causes headaches, dizziness, nausea, unconsciousness and death. It quickly deadens the sense of smell.

Hypoxia A zone of ocean with a depleted level of oxygen caused by the decay of excessive plant life stimulated by delivery of large amounts of nitrogen and phosphorus by a river. Such a zone occurs in the Gulf of Mexico due to the discharge of the Mississippi River.

Lagoon A manure treatment structure, typically earthen. Lagoons can be aerobic, anaerobic, or facultative depending on their design. An anaerobic lagoon is different from an earthen storage basin in that the lagoon is managed for manure treatment. Anaerobic lagoons are only partially emptied each year whereas earthen storage basins are emptied once or twice a year.

Manure The fecal and urinary excretions of livestock and poultry. Manure can include bedding material and water used for livestock. Types of manure have descriptive names such as liquid, slurry, and solid.

Manure storage area An area associated with an animal feedlot where animal manure or runoff containing animal manure is stored until it can be utilized as domestic fertilizer or removed to a permitted animal manure disposal site. Animal manure packs or mounding within the animal feedlot shall not be considered to be manure storage for these parts.

Methane (CH_4) An odorless, explosive gas formed during manure's anaerobic decomposition. Methane can cause headaches and asphyxiation in unventilated areas.

MPCA Minnesota Pollution Control Agency.

Nonpoint source Entry of effluent into a water body in a diffuse manner with no definite point of entry and where the source is not readily discernible.

Nutrient Elements or compounds essential to growth and development of living things (e.g., nitrogen, phosphorus, potassium).

Pastures Areas where grass or other growing plants are used for grazing and where the concentration of animals is such that a vegetation cover is maintained during the growing seasons, except in the immediate vicinity of temporary supplemental feeding or watering systems.

Pathogens Disease-causing organisms.

Permit A document issued by the Pollution Control Agency, at no charge to the applicant, which contains requirements, conditions, and compliance schedules relating to the discharge of animal manure pollutants.

Phased actions Two or more projects by the same proposer that will have environmental effects on the same geographic area and will occur sequentially over a limited time period.

Phosphorus A nonmetallic element that occurs widely and is essential to the growth of aquatic organisms as well as all forms of life. In aquatic environments, phosphorus is often the nutrient that limits the growth that a body of water can support.

Point source The release of an effluent from a pipe or discrete conveyance into a water body or a watercourse leading to a body of water.

Pollutant Any substance of such character and in such quantities that when it reaches a body of water, soil, or air, it is degrading in effect so as to impair its usefulness or render it offensive.

Risk The possibility of injury or loss. When used in environmental situations, ‘risk’ usually conveys the idea that the likelihood of an event is small but its consequences would be significant if it did occur.

Rotational grazing The practice of subdividing pasture and forage fields into small sections, or paddocks, and allowing the high quality forage to be grazed quickly.

Rural Of or relating to the country, country people or life, or agriculture.

Scoping Process to identify what potential environmental impacts, alternative and other issues will be addressed in the EIS.

Social Of or relating to human society, the interaction of the individual and the group, or the welfare of human beings as members of society. Tending to form cooperative and interdependent relationships with others of one’s kind.

Surface water Water present above the substrate or soil surface.

Sustainable agriculture Represents the best aspects of traditional and modern agriculture by using a fundamental understanding of nature as well as the latest scientific advances to create integrated, self-reliant, resource conserving practices that enhance the enrichment of the environment and provide short- and long-term productive and economical agriculture.

Sustainable development Or 'sustainability' is development that maintains or enhances economic opportunity and community well-being while protecting and restoring the natural environment upon which people and economies depend. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

Value added The value of the firm's output minus the value of the inputs it purchases from other firms or enterprises. In common, usage it refers to the portion of firm profits that accrue to owners who supply agricultural products as inputs to the firm.

Vertical coordination When two or more firms whose activities extend over more than one successive stage of production form an agreement or alliance to coordinate their vertically related production processes.

Vertical integration A single firm whose activities extend over more than one successive stage of the production process transforming raw materials into final goods.

Water quality The biological, chemical, and physical conditions of a water body.

Watershed The surrounding land area that drains into a lake, river or river system.

Appendix B1

Summary of Public Comments and EQB Staff Responses

The Citizens Advisory Group (CAC) and spent more than three years working on the GEIS. During that time the original scoping questions were modified at several points as investigations revealed what could be accomplished with the resources available. After preparing the Scoping Document and working with consultants to finalize the two-volume, 1500 page Literature Summary and the 11 volume , 2500 page technical work papers (TWP), the EQB issued a Draft GEIS summary document. This Draft GEIS was intended to summarize the most significant findings of the supporting documents and to contain the policy recommendations obtained through the intensive discussion and unanimous consensus of the CAC. The Draft GEIS was made available on the Internet on August 15, 2001. A series of eight public meetings on the Draft GEIS and supporting technical documents were held throughout Minnesota during August and September 2001.

A number of persons appeared at the public meetings to give testimony and others submitted written comments. In many cases persons who appeared and gave oral testimony also submitted written comments which reiterated or supplemented their oral testimony. EQB staff collected these comments and responded to items determined to be substantive comments. This appendix contains a summary of the comments. Copies of extracts of the oral comments made at public meetings are found in Appendix B2. All written comments received are provided in their entirety in Appendix E. These written comments contain additional supporting information, many personal anecdotes and a number of good ideas for additional policy recommendations or research. Material extracted from these comments and responses are contained in this appendix. Throughout the comments and responses, reference is made to policy recommendation numbers. These numbers refer to the original 77 policy recommendations developed by CAC and unanimously agreed to by the group. All of these policy recommendations are found together in Appendix D.

Copies of all written comments received were presented to the CAC to assist them in their deliberations on the draft GEIS document.

Comments tended to cluster into a few major categories.

1. Comments about the specific policy recommendations
2. Comments of a broad general nature beyond the scope of the GEIS
3. Comments addressing specific errors or omissions in the draft GEIS

4. Comments addressing specific topics that were dealt with in detail in the supporting documents.

Those comments from category 1, which related specifically to the CAC policy recommendations, were dealt with by the CAC at their November 2001 meeting. Those comments from categories 2,3,4 are summarized and responses provided in this appendix. Many comments did not call for a response. Use of the phrase, "No response needed" indicates that in our opinion the comment is either so general as to be outside the scope of the GEIS, an expression of personal preference or opinion which stands on its own merit, or a factual statement so obvious and widely accepted as to be self-evident. These comments were included because it was felt that these commenters expressed significant points of view or provided valuable information for consideration by the public.

It appears that many of the commenters did not access the supporting documents to the GEIS (Literature Summary, Technical Work papers, Scoping Document, GIS work papers) seemingly assuming that the draft GEIS document was all the information available on the topic in question. The Draft, Proposed Final and Final GEIS give a short summary of the most pertinent findings, for those individuals who have a more casual interest in a topic. It is impossible in a short summary document to provide the full information needed to answer the detailed questions in depth. In many cases when a commenter said there was not enough coverage of a topic provided in the GEIS, it is indicated that they should go to the Literature Summary or the appropriate TWP for more complete information. The supporting documents contain between 4,000 and 5,000 thousand pages of valuable information, including extensive references to source material. Anyone interested in a topic is strongly advised to review these additional materials for more detailed information.

General Philosophy

1. Sustainable agriculture can solve all our problems.

NO RESPONSE NEEDED

2. The comprehensive goal of the GEIS should be clearly stated near the beginning of the document. It should include the important values of the people of Minnesota, supporting evidence for these values and a description of the long range future envisioned.

The comprehensive goals of the GEIS and important values were included in the Executive Summary on page 2 and in the Introductory Section on page 4. The important values or themes are listed on page 21. The commenter also suggested EQB describe the long range future of agriculture envisioned fifty years from now. This task was beyond the scope of the current project.

3. The GEIS needs to focus more on the positive impacts of animal agriculture on the environment.

Throughout the GEIS information was included, as available, regarding positive impacts of animal agriculture on the environment. It has been one of the goals of the GEIS process from the beginning to include such information-- the Scoping Document clearly states that both positive and negative environmental, economic, health and social impacts were to be addressed. For example, the GEIS notes that well-managed, moderate grazing of animals can improve riparian habitat and several important benefits of manure to the physical and biological properties of soils are discussed.

4. We need more attention toward sustainable agriculture and the cumulative impacts of multiple large feedlots.

Sustainable agriculture and the cumulative impacts of multiple large feedlots are two important and complex topics. Although the GEIS deals with these issues briefly, we would agree that both topics merit further attention and future research funding. There was insufficient time, money and information available to provide greater detail on these topics in this document.

5. It is important to understand exactly how the GEIS will be used to improve and expedite the EAW and EIS process for feedlots.

The GEIS includes a section (page 11-12 of the Public Review Draft) that explains expectations for the use of the GEIS in future EAWs and EISs. As stated there, the GEIS is intended to serve as a ready source of information for EAW and EIS preparers, especially the latter, in dealing with economic, community and social effects. The GEIS does not substitute for site-specific EAWs or EISs on individual projects; rather it is hoped that these documents will simplify and expedite the preparation of project environmental reviews. In addition, in a more general way, by better informing the public about animal agriculture, the GEIS should reduce misconceptions, minimize unfounded concerns and fears, and allow for better-focused public review of individual projects. Additional information about the use of the GEIS in future EAWs and EISs is provided in response to comments #28 and # 29.

6. It appears that the goal of an expedited, more efficient feedlot permitting process may come at the expense of environmental protection.

It is extremely difficult to find the perfect balance between the seemingly contradictory objectives of speeding up the permitting process and providing an *adequate level of environmental protection. The CAC dealt with this dilemma by developing policy recommendation # 69, Appendix D.*

7. The GEIS should encourage the use of new technologies for controlling feedlot environmental problems.

The GEIS does encourage the use of new technologies for controlling problems. For example, Theme 5 (page 16, Public Review Draft) contains the subtheme "support additional research on odor and air emission mitigation." Policy recommendation # 17, Appendix D, encourages and supports research and development of air quality control technology and its transfer. Policy recommendation # 20, Appendix D, supports increased federal funding for odor and air quality research. Regarding water quality, Recommendation #34 in Appendix D, supports research, development, and technology transfer of improved feedlot operations and manure quality control technologies. On page 139 in the Air Quality and Odor chapter, the GEIS contains a statement that development of better mitigation technologies would be in everyone's interest. The Soils and Manure chapter states (on pages 152 & 155) that government policies may need to be changed to adapt to technological changes in the livestock industry.

8. The freedom to farm should not be jeopardized by half-truths and unsubstantiated accusations.

NO RESPONSE NEEDED

9. Our right to personal privacy is not negated simply because we farm.

NO RESPONSE NEEDED

10. In the Introduction to the Proposed Final GEIS (paragraphs 5 and 6), you have chosen to insert language taken verbatim from a letter to you from Gene Hugoson, Commissioner of Agriculture, dated October 25, 2001. This language makes assertions that not only do not appear in the GEIS, its Technical Work Papers, or its Literature Review, but which are in direct conflict with findings from these sources. Pursuant to MINNESOTA Rules 4410.2700, Mr. Hugoson's assertions should be included in the EQB's response to comments (they are not), and responded to in consideration of the actual content of the GEIS. As the language in question is wholly unsubstantiated, and, again, in conflict with the findings of the GEIS, I am confident that EQB's reasoned response will be to remove it from the Introduction.

As suggested, the language has been deleted. The entire letter appears with all other written comments received in Appendix E.

11. The consensus recommendations are the most important deliverable out of the entire GEIS process.

NO RESPONSE NEEDED – See Appendix D to view all CAC consensus policy recommendations

12. Voluntary quality assurance and product certification programs are a good idea.

NO RESPONSE NEEDED

13. The draft Final GEIS is written in a manner that implies that environmental regulations are the major concern of animal agriculture in Minnesota. This is not only an oversimplification of the issues but is not supported by the technical work papers. Not only does the draft Final GEIS ignore the growth of animal agriculture in states and countries with strong environmental regulations, but more significantly it ignores the significant roles economic development, social values (small vs. large feedlots), aging infrastructure, and research and technological developments have on animal agriculture independent of environmental regulations.

The author's interpretation is that environmental regulations are the major concern of animal agriculture in Minnesota. We would stipulate that the Literature Summary, most of the TWPs and many public comments support this general conclusion. We maintain that concern about the costs of increasing environmental regulation during a period of declining profitability is one of the primary concerns facing the Minnesota livestock industry. Obviously, many additional factors must also be considered in a more thorough analysis. Many other factors mentioned and are important in analyzing the industry.

14. Minnesota should ban large feedlot facilities and encourage sustainable and alternative systems.

NO RESPONSE NEEDED

15. The CAC is biased in favor of large production facilities and does not adequately address smaller sustainable alternatives.

The CAC was established by the Environmental Quality Board to include a reasonable balance of interests. Its membership includes several who have been persistent advocates for considering alternative methods of animal production. Because the CAC has operated by consensus, all scoping questions, technical studies, and recommendations have been agreed to by all interests on the CAC.

16. Animal agriculture is vital to Minnesota, especially Southeast Minnesota.

NO RESPONSE NEEDED

17. Citizens are only protected when EIS requirements are enforced.

NO RESPONSE NEEDED

18. In the Role of Government chapter, the section entitled "Observations on the MPCA Feedlot Program Under the Revised Rules," legislation enacted in 2000, which is in direct conflict with federal law, is mentioned, though the conflict is not. Three provisions are in such conflict: 1) The prohibition on MPCA enforcing state rules unless public subsidy is available (this one is mentioned as being in the legislation, but not as being in conflict with federal law); 2) Less restrictive numbers for calculating "animal units" than are contained in the Code of Federal Regulations (this one was included in the CAC-reviewed draft and dropped without explanation from the final draft); and 3) The prohibition on the MPCA placing conditions in NPDES permits that are not specifically spelled out in state rule or law or are not agreed to by the permittee.

The EPA is currently deciding whether to request amendment of the 2000 legislation or to impose restrictions on MPCA's delegation of authority to administer the NPDES permitting program for CAFOs.

The author's made an editorial decision not to include discussion of this topic in the Proposed Final GEIS. It was felt that the issue was adequately dealt with in the Role of Government TWP. The complexity of the topic was such that concise treatment in the summary document was not possible.

19. The Minnesota Corn Growers Association believes that it is possible to produce at high levels while maintaining the quality of our natural resources. We support the implementation of sound stewardship practices; historically, research and educational efforts have resulted in adoption of practices that strike the optimal balance between productivity and conservation. Programs that help achieve this should be available to farms of all sizes. The government must maintain a role in assuring a safe, healthy and abundant food supply.

NO RESPONSE NEEDED

20. Nowhere in the GEIS are producers given recognition for the benefits they have provided to the environment, through past and ongoing investments in stewardship practices. Farmers have invested significant private assets into their facilities to improve stewardship. The GEIS should recognize this and outline what a reasonable expectation of private investment should be in the future.

It is acknowledged that such information is not included within the GEIS; however, it is not called for within the study questions of the scoping document.

21. The GEIS insinuates that large facilities are causing more environmental degradation. However, nowhere are considerations given to the environmental balance of the agricultural spectrum of the past that included more livestock operations spread throughout the state, and the environmental impacts those operations had.

The GEIS is intended to present the highest quality information available. It is not possible for the EQB to prevent individuals from inferring particular conclusions from the facts presented. To our knowledge, nowhere is it specifically stated that large feedlots are causing more pollution than was present when there were a larger number of smaller operations more widely scattered across the state.

22. I commend the many people who worked on this report. Although the GEIS does not answer all of the questions in the Scoping Document, it appears to achieve the goals of bringing together and summarizing a wealth of information, identifying information gaps, and integrating many perspectives in its policy recommendations. The more comprehensive and common base of information developed should be a substantial asset to the many people involved in animal agriculture in Minnesota.

NO RESPONSE NEEDED

23. Government success depends on a fully informed public. Local and state policies need to respond to everyone's concerns about feedlots, not limit their acceptance of complaints to those of immediate neighbors.

NO RESPONSE NEEDED

24. The GEIS should be disseminated widely and well-publicized as it contains a lot of good information

It is the intention of Minnesota Planning and the EQB, to do exactly what this commenter suggests, primarily through use of the Minnesota Planning Web site. All the supporting documents (Literature Summary and Technical Work Papers) are already posted and available. We will publish a CD containing all project documents and work through the media for wide public dissemination of all GEIS information.

25. The GEIS does not follow through on the intent of the Scoping Document to study cumulative impacts

The GEIS recognizes the importance of cumulative impacts from animal agriculture facilities. This item is discussed briefly in the GEIS on page 86, which refers to Chapter 6 of the Role of Government Technical Work Paper, pages 136 - 150, which cover this topic in more detail. Cumulative impacts are an extremely complex subject. While both the CAC and the EQB support additional research and funding in this area, additional discussion is beyond the scope and budget of the present GEIS. Preliminary estimates from qualified consultants that a study of this type would require, at a minimum, an additional $ 500,000.00 in project funding for a limited study of the issue. In addition much of the information collected will be useful for the formal conduct of the macroscopic level of the cumulative impact of any given proposed project. The missing information is the project specific information required by a new project and the meso-scale or regional information integrating the individual facility into the entire ecosystem and estimating the magnitude of other contributors to the overall problems of concern.

26. The GEIS is commended for including the Phosphorus Index work

NO RESPONSE NEEDED

27. Minnesotans will only be well-served when there are adequate laws and staffing across all jurisdictions, all of which support achieving clean air and water.

NO RESPONSE NEEDED

28. Not mentioned is the current misuse of the EAW and the EIS petition process and costs. These two tools that should be used to find facts are currently used as a form of harassment and to raise the costs of the over all proposed project to a level that discourages and prohibits the project. These costs should perhaps be placed on the petitioners or the local or state governments not the producers.

It is clear that a number of livestock producers feel that the environmental review requirements for the preparation of EAWs and EISs place an undue economic and regulatory burden on them. The Role of Government TWP researched this issue and discovered that only a very small fraction of feedlots (less than 1. 2 percent) actually do the most minimal environmental review, as represented by an EAW. Producers may also believe that the requirement to collect environmental background information and monitoring data is excessive and may be used to harass their business operations. EQB staff would stipulate that the nature of all business operations is changing rapidly. Environmental review is a normal legal requirement for many types of business operations and land uses. This *information is deemed increasingly important to protect and maintain public health. It should be considered a normal cost of doing business, not a penalty.*

There is no reliable way to determine what motivations individuals might have for requesting that environmental information on feedlots be collected as part of environmental review. The suggestion that petitioners should pay the cost of collecting environmental information for proposed feedlots is unprecedented. Clearly, the operation seeking a facility permit is the direct beneficiary of any profits made. One major intention of the GEIS was to collect general environmental information at public expense to help minimize future costs of environmental review for individual feedlot projects.

29. The proposed final GEIS contains new language in the "Role of Government" chapter, final paragraph of the section on "Observations on the Effectiveness of Environmental Review." The language was added in response to comment #28 (Appendix B1 - Summary of Public Comments and EQB Staff Responses). The comment asserts, "The GEIS fails to discuss the current misuse of the environmental review process as a harassment tool to raise the overall costs of a feedlot project to discourage its completion..."

EQB's response, included in the GEIS, states, "Some feedlot producers perceive that environmental review is sometimes used by feedlot opponents as a weapon to stall or stop feedlot proposals, or to harass producers. Oftentimes, the producers believe that the alleged environmental effects cited by the opponents are imagined or exaggerated, serving merely as an excuse to bog the project down in an EAW or EIS process, and the real motives of the opponents have nothing to do with environmental concerns."

EQB's new language is entirely unsubstantiated, and in fact is roundly contradicted by the actual GEIS findings discussed immediately above it, notably that 1) an EIS has never been prepared for a feedlot; 2) a mere 1.2 percent of new facilities have undergone preparation of an EAW; and 3) the value of publicly raised issues in finding mitigation solutions.

The authors believe that their response to comment #28 on the Proposed Final GEIS is appropriate. Some individuals in written and oral comments, did express this concern about the potential misuse of the environmental review process. This perception does exist and it may help to explain some observed behavior on the part of certain members of the regulated community. The added paragraph will remain in the Final GEIS document.

GEIS Process

30. You need to identify those issues that were not included in the documents because consensus was not reached by CAC.

This would be an impossible task. The CAC met monthly for three years usually for two full days at a time. During this enormous amount of time a great many ideas and issues were aired by the 25 CAC members, often during difficult and confusing discussions. Despite everyone's efforts to keep track of and document those discussions, it is well known that many thoughts aired did not get fully documented. Any list of issues raised but not agreed to by consensus would necessarily be incomplete, and thus potentially biased. If any individual is extremely interested in the complete debates that occurred at the CAC meetings, EQB staff maintain copies of about 300 hours of taped CAC meetings. Any person can borrow these tapes and listen to the actual discussions that occurred.

Beyond the practical obstacles to compiling a list of unsuccessful recommendations, it is not clear that any such list would be particularly useful. It is very easy to generate a long list of alleged issues involving animal agriculture – as the EQB has done through the pre-scoping meeting process documented in the Scoping Document. The difficulty is in getting widespread agreement acknowledging which issues are indeed legitimate. It can be argued that a strength of the GEIS is that those things included as issues are acknowledged by the members of a diverse committee as legitimate issues. Appendix E of the Final GEIS includes a list of policy ideas discussed during the process where unanimous consensus was not reached.

31. EQB needs to develop a process to periodically revisit issues as changes occur or new issues arise, so the GEIS can be updated.

We agree that the GEIS document would benefit from periodic updates. This issue is discussed in the proposed Final GEIS on pages 15 and 16. CAC Policy Recommendation # 53, Appendix D, does endorse the idea of annual updates to the GEIS. Currently, the EQB does not have the staff or funding to follow through with this recommendation. A portion of the Final GEIS will include funding requests and suggested implementation steps the Legislature could take to maximize the value obtained from the GEIS process.

32. The GEIS lacks specific interim recommendations to protect the public while research and studies are being conducted.

While some recommendations do depend on additional study and information, many of them can be implemented in the immediate future. There does not appear to be any reason to designate a subset of the CAC policy recommendations as "interim."

33. The GEIS should be careful in recommending certain modeling tools. Rather it should be advocating for a state model approval process that makes the best tools available to the public at large.

The language on modeling tools is very careful to state that the CAC encourages the use of continuous improvement and field validation of all applicable computer programs and models, which can aid in predicting appropriate operational practices, setback distances and odor levels. The mention of the OFFSET model in no way implies an exclusive recommendation, but is merely an example of a University of Minnesota-developed model widely familiar to many in the regulated community. The EQB clearly supports the inclusion of many different tools for dealing with the variety of feedlot situations found in Minnesota.

34. The GEIS does not adequately examine the alternatives to large feedlots.

This issue was discussed on pages 9 and 10 of the Introduction to the Draft GEIS. An original intention for the Scoping Document was to examine alternative paths for animal agriculture that can optimize benefits in relation to the environment, economy, health and way of life in the state, with particular emphasis on sustainability. This goal proved to be far more elusive than was originally anticipated by the CAC. After more than one year of extended CAC committee meetings and discussion, no agreement could be reached on how to define various alternatives. The CAC reluctantly agreed that it would not be able to do an alternative analysis in the GEIS. The analysis of alternatives is much more appropriate when considering a single proposed feedlot project.

Analysis of alternatives is extremely complex work, given the nearly infinite number of existing and possible configurations of the livestock industry and the lack of ability to measure expected benefits of any specific configuration. While some limited information on alternatives was provided in the proposed Final GEIS, pages 30 to 43 and the Description of Animal Agriculture in Minnesota Technical Work Paper, this information only begins to answer the question posed by this comment. A more thorough answer to the question is far beyond the scope of this project and the limited time, money and information available. Economic forces currently in play seem to be driving the livestock industry toward consolidation into larger facilities than was common in the past. Social and economic forces are driving many farmers to experiment with alternative and sustainable production systems.

35. The GEIS has utterly failed in carrying out the charge of the Scoping Document to look at CAFO's and their social, economic and environmental impacts in the context of the alternative animal production paths. This is my most fundamental objection. The very title of the document should be changed. You have not looked at "animal agriculture," you have looked at Concentrated Animal Feeding Operations. Second, if the problem you had in meeting the challenge of Scoping Document to look at alternative paths was a dearth of research, why did not that finding come through more clearly in your recommendations? In recommendation

#59, you urge an "exploration with community leaders, producers and stakeholders of alternatives'. …. Instead of the GEIS dismissing alternatives to industrialized animal agriculture, how about a strong recommendation to the Legislature that we need to introduce some diversity and fairness into the research agendas of the University and other state institutions? The questions I have as a livestock producer are not being raised by the GEIS process, and largely, they are not being addressed in publicly funded research.

Please see the response to comment # 34. The focus on CAFOs in the GEIS document is largely based on the public perception that these types of facilities are the major source of the changes and problems experienced in modern livestock production. The Final GEIS Summary document contains recommendations for further research. The issue of alternative systems is a high priority

36. The GEIS does not deal with the issue of cumulative impacts of large feedlots.

It has been a goal of the GEIS process from the beginning to address cumulative impacts of large feedlots. The issue of cumulative impacts is much like the issue of alternatives. The problem is easily stated, but as parameters for analysis are defined, it becomes enormously complex. The Scoping Document states, in Step 3 of the Study Framework section, "particular emphasis will be given to any cumulative impacts of animal agriculture…"and the April 2000 Study Work plan includes a task titled "Cumulative Impacts; consolidation of information from Topics G [Water], H [Air Quality and Odor], and I/J [Soils and Manure] regarding density limits on animal numbers." It is not for lack of intent or interest that little information on cumulative impacts appears in the GEIS documents. There was a lack of information on cumulative impacts and insufficient time and funding to develop the additional information that would be needed to address cumulative impacts. See comment # 25 for additional information on this topic.

The GEIS does include information on certain cumulative impacts. For example, the Water Chapter includes various facts about the extent of impairment of waters or their loadings of nutrients, which is information on cumulative impacts. In addition, beginning on page 122, there is an analysis of animal densities compared to land capacity to accept manure. Further, the chapter addresses Minnesota's cumulative contribution of Minnesota to the hypoxia-causing nutrient loadings in the Gulf of Mexico. See Role of Government TWP pages 136 - 150 for a general discussion of the cumulative impact analysis problem.

Regarding air quality, the GEIS provides information about modeling tools that can be used to estimate cumulative impacts of multiple feedlot sites, although no application of those techniques appears in the GEIS document. However, the GEIS project has provided funding to assist with the cumulative air quality impact *modeling of multiple sites as part of a project-specific EIS which is intended to serve as a case study for the cumulative air quality issue.*

Because of various delays the EIS modeling will not be available to present in the GEIS document. However, the results can be used by the MPCA to guide future modeling work just as if the information had appeared in the GEIS.

37. I am profoundly disappointed by the lack of focus on the cumulative impacts of CAFOs. My recollection is that the 1998 Scoping Document of the GEIS raised the issue of cumulative effects. I fail to see the 2001 document addressing it.

Please see the responses to comments # 34, 35 and 36.

38. I commend the CAC and staff for diligent and persistent efforts; the GEIS is an excellent foundation to be built on for the future.

NO RESPONSE NEEDED

39. The fact that the GEIS mentions the names of specific modeling tools as examples of tools available may be perceived as a promotion of those specific tools; also, some modeling tools are better than others, especially in certain applications.

Please refer to the response to comment # 33.

40. An adequate GEIS is important to Minnesota's agricultural economy and its environment. Without making sure the Final GEIS links to the Scoping Document and provides conclusions and determinations on broad animal agriculture issues, it will be difficult to reach a conclusion on adequacy. We strongly encourage steps be taken to address our concerns, and likely the concerns of other reviewers, before bringing the draft Final GEIS forward for a determination on adequacy.

The Scoping Document was an extremely important basis for the development of the GEIS process and documents. The Final GEIS document is being revised as suggested by the commenter to more closely reflect links to the Scoping Document. In the course of completing the project, there were a number of items that could not be completed as originally envisioned by the Scoping Document.

41. Contrary to the Scoping Document's indications, the GEIS fails to examine the impacts of large, industrial-type feedlots in the context of alternative animal production paths. The scope has been narrowed from "animal agriculture" to "CAFOs" (concentrated operations, generally over 1,000 animal units); this narrowing adds more weight to the myth that animal agriculture **means** concentrated feedlots, and that they are the only legitimate production method. Without taking a serious look at alternative paths, the GEIS continues the present "business as usual" trends and will help ensure that we never do better than minimal compliance with minimal environmental standards.

Please refer to the response to comment # 34 for an explanation of why the GEIS does not include more comparison of alternative paths for animal agriculture.

42. Unfortunately, the "Alternatives" section of the draft Final GEIS is almost nonexistent. This topic was deemed one of the most important in the original Scoping Document. It was identified as one of the overall goals of the Final GEIS. Yet, there is not nearly enough information in the technical work papers or the draft Final GEIS document itself for RGU's to evaluate the possible use of alternatives in a given situation. Conceptually, decision-makers faced with an animal agriculture issue should be able to refer to the Final GEIS and explore generic, well-reasoned alternatives. The failure to provide this analysis does a disservice to the public looking for answers and to producers looking for guidance on approaches that will streamline their efforts in developing their business to meet the needs of a changing industry in an environmentally sound manner.

Please refer to the response to comment # 34 for an explanation of why the GEIS does not include more comparison of alternative paths for animal agriculture.

43. On page 75, the third sentence of the final paragraph should be revised to read: "Currently there are well-developed programs in place to help a farmer build a new manure storage or feedlot runoff project, if the project addresses an existing environmental problem. State and federal cost-share, loan, and engineering assistance programs can help design, construct and finance such projects."

The GEIS language has been changed as recommended.

44. On page 76, the agency should be called "Board of Water and Soil Resources."

This correction has been made in the GEIS text.

45. On page 77, under state cost-share program, the GEIS should mention the $50,000 limit per project for state feedlot cost-share. Also, replace the second and third-to-last sentences of the paragraph with: "To be eligible for funding, feedlot pollution abatement practices must be on an approved conservation practice list. This list is approximately the same as for the federal cost-share program (EQIP)."

The language has been changed as recommended.

46. The section, "Observations on Impacts and Effectiveness of State Funding Programs," on page 77, indicates there are no published reports on effectiveness of the state cost-share program. While it is true there are no "reports," there is pertinent information available from the Board of Water and Soil Resources. The

Local Government Unit Annual Reporting System (LARS) includes pollution crediting estimates for many conservation practices including feedlot abatement practices. BWSR also has several fact sheets and GIS products summarizing the pollution credits for recent years and is leading development of a next generation electronic system for conservation practice planning and reporting.

The sentence stating there are no reports has been deleted.

47. On page 81, revise the last sentence of the second paragraph under "Observations on Impacts and Effectiveness" to reflect that the EPA and USDA published a unified national strategy for animal feeding operations in March 1999.

The language has been changed as recommended.

48. The GEIS does not address the role of government in facilitating communication, coordination, prioritization, and consensus building through the Feedlot and Manure Management Advisory Committee (FMMAC).

It is true that very little mention is made of the FMMAC in the GEIS. This is primarily because the role of FMMAC does not clearly fit under any of the Study Questions in the Role of Government topic. It is acknowledged that the FMMAC has served as a very useful forum for the discussion of various feedlot issues by a variety of interests. Two prominent examples of FMMAC contributions are its role as a sounding board for ideas as the Pollution Control Agency developed revisions to the state feedlot rules for the first time in 20 years and its role in sponsoring investigations that led to the OFFSET model for estimating setback distances from feedlots. A great deal of information about the FMMAC can be found at the Minnesota Department of Agriculture's website at www.mda.state.Minnesota.us. FMMAC has expressed a desire for only a limited advisory role in implementing the GEIS recommendations

49. It might be appropriate to retitle the water quality recommendations as "Water Quality, Soils and Manure Policy Recommendations," since there is no separate soils and manure recommendation section and many of the recommendations under water quality also relate to soils and manure.

The language has been changed as recommended.

50. In the Soils and Manure Chapter it would be good to include information about critical implementation issues and payback potential related to good nutrient management.

The most critical implementation issues relative to manure revolve around the new and updated requirements for manure management planning stipulated in the 2000 revisions to the feedlot rules. Increased documentation and formalization of *manure application procedures will require some adjustments by certain operations. All feedlot facilities must meet the nutrient rate standards for land-applied manure and meet all applicable setbacks and management requirements when applying manure near surface waters, wetlands or other environmentally sensitive features. In some cases facilities will have to begin using licensed manure applicators. Concerns about excessive phosphorus loading have become more formalized and some facilities may be affected by yearly and long-term phosphorus loading limits. The GEIS initiated the development of a Minnesota Phosphorus Index to assist farmers in dealing with this issue.*

The economics of nitrogen and phosphorus management and the economic trade-offs of manure and commercial fertilizer as sources of crop nutrients is detailed in the Soils and Crop Nutrients TWPs and corresponding sections of the Literature Summary. The secondary benefits of increasing soil organic matter, structure improvement and micronutrient addition are much harder to quantify economically. Generally accepted wisdom in crop production technology is that well managed manure is as good as and in some aspects a better nutrient source than, commercial fertilizer. The interested reader is directed to the references provided in the Soil and Manure and also Water Quality TWPs for more details.

51. On page 145, last paragraph, the commenter questions the accuracy of the statement that with liquid or semi-liquid sources, transportation costs for manure application by all types of methods become prohibitive beyond a one-mile distance.

The text on page 145 was quoted directly from page 4 of the Soils and Manure Technical Work Paper as submitted by the Soils Department of the University of Minnesota. The EQB relied on the technical expertise of the authors who made this statement. The original text will remain in place unless the commenter can provide suitable contrary evidence for review and consideration by the EQB and University of Minnesota staff.

52. The extensive information produced by this GEIS should be made widely available via user-friendly electronic methods.

It is the intention of the EQB to make the entire body of information collected as part of the GEIS process widely and easily available. Due to the large volume of pages, charts, maps and diagrams, (comprising more than 5,000 pages) , the plan is to post all documents on the "Feedlot" link of the Minnesota Planning home page. In addition we plan to produce a compact computer disk containing all documents for low cost distribution to interested members of the public.

This GEIS consolidated and developed substantial information that enables a more common understanding of many critical issues related to animal agriculture in Minnesota and helps define the best courses of action. In some cases the research pointed out how much was not known in certain keys areas.

53. Develop a strategy to continue to advance the understanding and use of the information assembled by the GEIS.

The EQB does intend to develop an implementation strategy based on recommended priorities arising from the GEIS process. We also will be suggesting funding priorities for program support and further research based on the GEIS investigations. The Feedlot and Manure Management Advisory Committee (FMMAC), with its broad membership, should be an important forum for ongoing education, coordination and advice to best utilize the GEIS. This includes advice from many perspectives regarding research needs and policy refinement.

Coordination and clarification of the top priorities of the involved EQB agencies, organizations and interest groups should be a topic of further discussion via the FMMAC and other venues. These discussions should include definition of who can do what to advance these priorities for action, and what additional resources and policy changes are needed.

54. The Citizen Advisory Committee (CAC) consists of stakeholders, including environmental groups. Only two spots out of 25 are of an environmental nature and one of the members resigned out of frustration. Even though consensus decisions of this group are defined as being supported by 100% of the members, one can easily understand the difficulty of being one against 24 on many issues. This committee is not representative of a true cross-section of stakeholders involved in animal agriculture and it should not be described as such.

The authors would disagree with the commenter's characterization of the CAC. Approximately 250 persons submitted letters of interest to participate on the CAC. The EQB members and staff reviewed all applicants and sought to fairly award membership to those groups and individuals who it was felt could make the greatest contribution to the process. Criteria of group affiliation, knowledge and technical expertise, and geographic representation were all part of the selection parameters. The 25 who were selected were carefully chosen to represent as many of the major stakeholder groups as possible.

During the project, at least one-half of the CAC members have publicly described themselves as environmentalists. The issue of the CAC's self-imposed requirement for unanimous consensus is a controversial one. However this is a ground rule they chose at the beginning of the process.

55. The "Role of Government" chapter section on "EPA Regulations Under the Federal Clean Water Act," contains a discussion of NPDES permitting for CAFOs, noting, "many CAFOs in Minnesota are still not permitted." By previous correspondence, Minnesota Center for Environmental Advocacy commented that only 25 of 808, or 3 percent, of CAFOs in Minnesota have been issued an NPDES permit. The EQB has chosen not to include this information, and has also not responded to the comment as required.

The rules covering the completion of a GEIS are silent in dealing with the issue of response to comments. We do have a duty to respond to those comments we determine to be substantive and have tried to include as many comments as possible in the response section. The referenced issue was covered in the Role of Government TWP.

56. On page 11 of the Draft GEIS , the statement is made that "...with respect to project-specific review it should be noted that the existence of economic and social issues concerning large feedlots as documented in the GEIS does not constitute a reason under Minnesota law to deny permits to individual feedlot projects provided they comply with environmental requirements." This is not true. Information contained in the GEIS can be used as supporting material for project-specific EIS reviews. Additionally, if an EIS were to be conducted on a feedlot, socioeconomic issues are indeed one of the decision-making criteria analyzed by the EIS (40 CFR 6.203© and Minn. Ch. 116D.04(e) Subd.2a). Permits can he denied based on the results of an EIS.

The authors believe the commenter is misinterpreting the intent of the language quoted. We believe this provision says that the existence of social or economic issues does not constitute adequate reason for denial of an individual feedlot permit.

The commenter is correct that social and economic information from the GEIS can be used in combination with project-specific information to aid in permit decisions. However, GEIS information should not be used in isolation, without verification or site-specific analysis to make the permit decision. At the individual project level, the role of GEIS social and economic information is to aid in evaluating feasible and prudent alternatives.

57. The GEIS Document over and over recommends additional study and research needs. All require financial and other resources to complete. In general, I agree that more research should be done. However, a caution. Significant resources should also be allocated to other approaches and studies that may direct us away from larger-sized, more concentrated and confined, animal agricultural methods. Two examples of such approaches come to mind:

- At the federal level, the principles contained in the Conservation Security Act
- At the state level, the partnership ideas and process under MISA - the Minnesota Institute for Sustainable Agriculture at the University of Minnesota.

Regulatory programs need adequate funding. New feedlot rules will not succeed unless all steps - permitting, inspection, monitoring .... and enforcement - receives the resources required.

NO RESPONSE NEEDED

58. As you are aware, the Minnesota Legislature has placed a moratorium on the use of earthen storage systems for swine manure. The moratorium ends six months after the completion of the GEIS (Laws 1998, Chapter 401, Section 52, as amended 2000). The GEIS is intended to inform the final decision on the appropriate use of earthen storage systems for swine facilities. The moratorium on lagoons should be expanded to include all feedlots. Allow existing feedlots to use liquid storage if they are reducing their animal units so their manure production capacity does not exceed agronomic rates for land spreading within one mile, based on a GIS coordinated nutrient management plan. Please expand on this issue in the final GEIS document.

After examining all available information and research on this topic, the CAC decided to recommend the continuance of the moratorium on open-air swine lagoons indefinitely. This item appears as policy recommendation # 77, Appendix D. Staff's analysis of the issue is that the moratorium on open-air swine lagoons should ***not*** *be expanded to all types of feedlots. Differences in the chemical composition and physical behavior of different kinds of animal waste dictate that what is needed for pig manure will not necessarily be required for cow or poultry manure. The moratorium was enacted due to very specific problems with swine facilities. It is not reasonable to modify these prohibitions to fit facilities that have different kinds of problems.*

59. Each recommendation should have specific supporting justification in the body of the document. (See policy recommendation #23 that refers to a program that has no mention in the text.) The recommendations themselves should be action statements based on the document text and should not include additional narrative material. (See #23 again)

Whenever possible, CAC policy recommendations have been incorporated in the text so that the suggested policy is followed by supporting information. The policy and priority section of the Final GEIS Summary document attempts to provide justification for the individual recommendations. We believe that narrative material is necessary for clarification. The text for policy # 23 comes directly language discussed and unanimously approved by the CAC. The Minnesota Department of Agriculture singled out the Michigan Agriculture Environmental Assurance program as an example they wish to emulate in our state.

60. Placing recommendations at the beginning of the document requires that a reader accept them before reading the supporting material in the separate chapters. Clarity and credibility would be better served if they were placed at the end of, or within, each chapter. If all of the recommendations must be placed together, they should at least be in the same order as the subject chapters.

Individual policy recommendations have been prioritized and explained in the policy and priorities section of the Final GEIS Summary document. These are followed by supporting narrative. All policy recommendations as they were developed and approved by the CAC are contained in Appendix D. These are in the original numerical order because much of the earlier material refers to them by CAC number.

61. These recommendations should be worded so as to be implementable. I would hate to have to form an "Implementation Advisory Group" a la the Forestry GEIS. Each recommendation should include a specific answer to the question: WHO DOES WHAT?

All the proposed policy recommendations originally had generic language stating, "the appropriate state agency(s) should require …." The CAC found this wording contrived and demanded that it be deleted. The recognition was that state agencies were the primary vehicle for carrying out most of these policies. In some cases, it was not readily apparent which agency(s) had authority or responsibility to enforce the provision. Where we can clearly identify the implementing agency, we will include that in the policy wording. The other difficulty was that staff recognized that many of these recommendations would undergo significant revision prior to being enacted into law, rule or ordinance. We felt that it was potentially dangerous to make a recommendation too specific at this early stage. We are also considering that recommending some sort of Animal Agriculture Implementation Advisory group may be an appropriate outcome of the GEIS as part of the document updating and adequacy functions.

62. In addition to more focused conclusions, the recommendations provided in the Final GEIS should be categorized and prioritized. There seem to be categories of recommendations - some require federal action, some require state action, and some require local action. For instance, while some changes are needed at the federal level, the implementation plan could direct state agencies to draft the needed correspondence to encourage federal action. This can be done even in times of budget shortfalls. If action is needed by a specific agency, the agency is able to review its resources and consider priority shifts to meet needs. Failure to categorize and prioritize recommendations will likely result in a scattered approach to addressing the issues raised in the Final GEIS and continue to leave animal agriculture and the citizens of Minnesota with significant uncertainty about what is needed in the future.

The Final GEIS has been revised to categorize and prioritize recommendations as suggested by the commenter. We have also added language encouraging cooperation of state authorities with local units of government and the federal government on transboundary issues involving more than one level of authority.

63. In reading the November 26, 2001 version of the draft Final GEIS, the recommendations appear to have been developed without reference to the Scoping Document and thus, it is difficult to determine if the Scoping Document questions were answered.

The Final GEIS is being revised to show the relationship between the policy recommendations and material developed in the Literature Summary and TWPs to the Scoping Document questions more clearly. In cases where the scoping questions were not answered completely explanation is given as to the reasons for these omissions. In many cases the policy recommendations do not arise directly from the answers to the scoping questions.

64. The MPCA's review of the draft Final GEIS revolves around the use of the GEIS as a tool and guidance document for a Responsible Government Unit of (RGU) making decisions on environmental review for a specific project. This is important to us because the MPCA is the RGU for the State's large animal agriculture project proposals.

The EQB and MPCA have different understandings and expectations of what the Final GEIS Summary document would contain and how it would be used. We believe that the material in the Literature Summary and Technical Work Papers would be of more use to the RGUs in supplementing site-specific feedlot environmental review. The material in the Final GEIS Summary document is more general and focuses on issues of policy priorities and resource limits. We feel this document would be of more interest to legislators, local officials and members of the public. MPCA staff was active on the CAC during the entire GEIS process including the review of all draft documents. EQB staff is currently working with the MPCA technical staff to revise the GEIS to better reflect the needs and issues raised by the MPCA. We believe the GEIS documents will fulfill most of the expectations of the MPCA and the others interested in feedlots.

65. One purpose of a GEIS is to address broad issues generically rather than on a case-by-case basis for each individual project. The Final GEIS was to provide proposers and RGUs with basic information on animal agriculture and to settle at least some of the broad or common issues that were repeatedly being raised in project-specific environmental reviews.

<u>Generic issues related to environmental topics</u>. The MPCA believes that the following are generic environmental issues common to all livestock operations: land application, manure storage, odor, antibiotic resistance, best management practices for air and water protection, greenhouse gases, human health risks posed

by livestock operations, air and water monitoring techniques, and impacts related to chemical application of commercial fertilizers, pesticides and herbicides.

Generic issues related to non-environmental topics. The MPCA believes that the following are generic non-environmental issues common to all livestock operations: social values related to the size of farming operations; relationship between livestock production, processors and consumers; treatment of animals; zoning and land use planning strategies; property rights; animal agriculture industry structure; market inefficiencies and market entry strategies; economies of scale related to the size of farms; and economic cost/benefit analysis.

The authors believe that the GEIS has addressed these issues in the existing documents. The EQB and the MPCA have different expectations of what the GEIS document should contain and how much material is adequate on any particular topic . The MPCA staff was active on the CAC during the entire GEIS process, including the review of all draft documents. We worked with MPCA technical staff to revise the Final GEIS to include as much of the information requested by MPCA as possible. We believe the entire set of GEIS documents will fulfill most of the expectations of the MPCA and meet any reasonable test of adequacy. This document is not intended to replace the detailed information collected by the MPCA as part of the permitting process. Instead the GEIS provides a broad overview of the general interrelationships of complex topic areas. An RGU would use GEIS information to supplement the project-specific information collected for the permit.

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Overall Description of Animal Agriculture

66. Rotational grazing is not adequately discussed.

New information describing rotational grazing has been added to the Description of Animal Agriculture chapter based on the Description of Animal Agriculture TWP. Rotational grazing was addressed to some extent in the Public Review Draft of the GEIS, notably some information comparing the economic performance of rotational grazing operations with conventional systems (page 101) and information indicting that good grazing management can improve the quality of riparian zones (page 118).

67. The number of total animal units in Minnesota has remained remarkably stable from 1945 to 2000.

A table extracted from Minnesota Department of Agriculture data provided by one commenter showed that the total number of animal units in Minnesota over the last fifty years has remained very close to 6,000,000, even though the percent of various species has changed over time. It is not clear if this relationship is *coincidental or indicates some underlying observation of the state livestock animal carrying capacity.*

68. The GEIS should expand the information about historical trends in animal numbers back to the 1950s to enhance the historical perspective given.

Please refer to the response to comment # 67.

69. In the "Description of Animal Agriculture," "General Changes in Agriculture" section, language regarding the decline in the proportion of farms operated by the full owner has been stricken. No explanation for this is provided in the Response to Comments section, nor is a comment suggesting it be stricken presented there. Substantiation for this deletion should be provided, or the language should be reinstated.

The authors examined the paragraph in question and were unable to verify the data or acquire better figures, so it seemed most appropriate to delete the confusing text.

Social and Community Impacts

70. The state should take a more proactive role in helping rural communities deal with the demographic and economic changes in agriculture.

Minnesota Planning currently provides a number of these services to local units of government through its various functions, Demography, Local Planning Assistance, Critical Issues, Land Management Information Center and the Environmental Quality Board. The University of Minnesota Extension Service, Board of Water and Soil resources, Department of Agriculture and Pollution Control Agency also provide public education and technical assistance on these issues.

71. The Social research paper did not include the impact of processing plants on livestock agriculture.

The Scoping Document does not include any study questions under Topic A, Social/Community, covering the impacts of processing plants. Topic F (now covered as part of the combined economics topic DEF) does include a Study Question (# F.1) asking "What are the overall economic benefits of animal agriculture (from all sources, including spin-off economic activity?") New information on the overall economic benefits of animal agriculture to the Minnesota economy has been added to the GEIS Economics and Description of Animal Agriculture sections. The Minnesota Department of Agriculture is a good *source for financial and economic information on this aspect of animal agriculture.*

72. Livestock and crop production together provide more income and employment on the same limited land base than crop farming alone; thus, animal agriculture helps preserve rural community population.

NO RESPONSE NEEDED

73. Commenter described personal experiences with problems due to odor, noise, truck traffic, and personal harassment from a neighboring beef feedlot.

NO RESPONSE NEEDED

74. Commenter described how family operates a dairy farm in central Minnesota according to principles of good husbandry and land stewardship, and is concerned about the possibility of more red tape and costs resulting from the GEIS recommendations

NO RESPONSE NEEDED

75. Sustaining rural communities depends importantly on small and medium-sized farmers receiving an equitable price in order to survive and have a quality of life; time is of the essence in assisting rural communities survive.

NO RESPONSE NEEDED

76. Family farmers need to be helped, they are the backbone of our nation.

NO RESPONSE NEEDED

77. Agricultural families need state help to ensure insurance coverage so that working off-farm is an option rather than economic necessity because they cannot afford health insurance. Farm operators across the state are increasingly engaged in off-farm employment, implying that farming is increasingly becoming a more part-time occupation.

The Social and Community TWP does find that more members of farm families are working off the farm than in the past. The presumption was that this trend was due primarily to additional income needed to maintain the farm operation in light of declining earnings from farm products for smaller farms. The TWP did not explore the insurance issue. We do not have enough information on health insurance needs in rural communities to make a recommendation at this time.

78. I am concerned that corporate agribusiness, accompanied by agricultural higher education, shares an expansionist mindset, fostering an almost singular trend toward bigness in all farming practices. I am concerned that solid scientific agricultural research about different farming methods may be compromised because of the ever-tightening link between agricultural companies and university research institutions. The risk of 'privatization" of basic research, as citizen (public) support of higher education drops, is will the right research questions be asked, and will untoward results be further explored or even shared.

NO RESPONSE NEEDED

Land Use and Conflict Resolution

79. City residents moving to the country need to be more tolerant of livestock odors.

NO RESPONSE NEEDED

80. Large feedlots with absentee owners should not be considered an agricultural land use, but rather as industrial uses restricted to industrial zones.

See the Land Use Conflicts and Regulation section of the Draft GEIS document, on pages 60 to 69, and the Land Use Conflicts and Regulation Technical Work Paper. Zoning decisions are best made by local jurisdictions. The GEIS offers a number of potential zoning tools for consideration by local units of government. There is no blanket statewide recommendation to use an "industrial agriculture" zoning class.

81. There should be some way provided, in the statutes, so when a citizen with irrefutable and overwhelming evidence to support the fact a feedlot is improperly located and does not have valid permits, does not have to hire a lawyer and take the matter to court to get the feedlot problem that is having a devastating effect on someone's quality of life and/or property value as well as the environment corrected. Perhaps there should be someone who goes around and audits work of county feedlot officers.

The Land Use TWP and CAC policy recommendation # 46 contain a number of suggested techniques for dealing with feedlot conflict resolution One suggestion is the creation of a special feedlot conflict resolution team made up of a core of persons at the state level with required technical knowledge and conflict resolution expertise. This standing team could be supplemented with appointed local persons having background or authority for any particular situation that may arise.

82. Real estate agents should be required to inform potential homeowners of the agricultural make-up of an area, and what rural homeowners can and should expect living near agricultural operations before individuals can purchase the home.

NO RESPONSE NEEDED

Role of Government

83. We need to stress the importance of data privacy for the individual producers.

The extent to which data on individual farming operations provided to or obtained by state agencies or local units is private (i.e., not available to the public) is governed, as is other government data on citizens and businesses, by the state Data Practices Act. Any changes desired in the level of privacy would need to be addressed through amendments to that act.

84. The state should provide public funding of basic agricultural research, not fund projects for private companies.

NO RESPONSE NEEDED

85. If Minnesota enacts regulations more stringent than neighboring states or provinces this will drive the livestock business out.

NO RESPONSE NEEDED

86. The state needs to provide more money for county feedlot officers.

It appears that the County Feedlot Officer provides a valuable service in many locations. While not every county has such a position, it may make sense for the state to increase funding available to hire and train feedlot officers. In regions with low animal densities it may make sense for two or more counties to share the expense of such a staff person. It may also make sense to look at funding such a position on a local watershed basis, through BWSR's programs.

87. Present feedlot laws are adequate. Excessive regulation will push farming out of the United States.

NO RESPONSE NEEDED

88. It would make more sense to use number of animals instead of animal units.

NO RESPONSE NEEDED

89. Senator Dayton stated that he will make enforcement of local feedlot regulations and ordinances, “one of my most important challenges.”

NO RESPONSE NEEDED

90. Farmers need a quick and efficient feedlot permit process.

NO RESPONSE NEEDED

91. The Role of Government paper did not adequately explain how the regulation of feedlots is fractured among a number of state, county and local jurisdictions.

It is true that many levels of government have programs that regulate different aspects of feedlot operation. Often there is little or no communication between units regulating the same operation. Many farmers have lamented this situation and requested a one-stop location where they could deal with all government programs affecting their operations more easily.

The Role of Government TWP focuses on state and federal regulation of feedlots. The Land Use Conflicts TWP focuses on county and township regulation.

92. I am for very tight permitting up front and very strict enforcement of regulations

NO RESPONSE NEEDED

93. Feedlots with less than 500 animal units should be exempt from most regulatory requirements.

NO RESPONSE NEEDED

94. In some aspects Minnesota’s new feedlot rules are less stringent than EPA requirements. There was substantial objection to the Minnesota feedlot rules by several Minnesota environmental groups.

NO RESPONSE NEEDED

95. State should develop an oversight mechanism to assure that feedlot regulators do their jobs properly and to which the public can appeal without the expense of court; this authority should audit the work of county feedlot officers.

NO RESPONSE NEEDED

96. The state needs a testing and certification program for all personnel authorized to issue feedlot permits.

NO RESPONSE NEEDED

97. Commenter described series of alleged mistakes made in the approval process of a certain feedlot.

NO RESPONSE NEEDED

98. Feedlot enforcement should be quick and involve expensive fines that increase with the size of the operation.

NO RESPONSE NEEDED

99. The Minnesota Department of Agriculture has a more favorable reputation than the MPCA and is more willing to find solutions and solve problems to the satisfaction of all parties.

NO RESPONSE NEEDED

100. The GEIS should include mention of the economic and emotional toll of increased regulation and increased public scrutiny of animal agriculture.

This item is dealt with extensively in the Social and Community TWP and also in the section on Social and Community Issues. There is no doubt that changes in the nature of livestock operations are causing distress to many farm families.

101. While it is true that the GEIS does not replace the need for a site-specific EAW or EIS on individual projects, the GEIS should provide information that answers questions that may otherwise have triggered the need for a discretionary EAW or discretionary EIS; the GEIS should be usable to answer concerns and sometimes those answers could alleviate the need for a discretionary EAW or EIS.

The authors that the GEIS should provide information that answers questions raised by the public, local officials and regulatory authorities. In some cases, this resource of information may answer concerns or reduce the scope of inquiry in feedlot environmental review. This could theoretically alleviate the need for, or the extent of, environmental review required for a specific project.

However, it is not a necessary purpose of the GEIS to alleviate the need for discretionary EAWs or EISs. There is no basis in the legislative directive that the EQB prepare this GEIS, in the EQB rules governing preparation of a GEIS, or in the GEIS Scoping Document to support the assertion that the purpose of the GEIS is to reduce the need for project-specific environmental review. Rather, all of these sources stress that the GEIS is a long-tern, "big picture" study of the livestock industry as a whole.

The GEIS answers many, but not all, questions. If there is an intent to delay or prevent a project one can always request new information or further investigation of any topic. In many cases the public, or local officials, have a sincere concern over potential impacts and a distrust of regulatory authorities who are reviewing and granting permits. It is often difficult to know how much information is needed before a decision can or must be made. Also, there will always be emerging issues, which were not covered or insufficiently covered, by the GEIS. This dilemma speaks to the need for a process to continually update the GEIS so it does not become less valuable over time.

102. The statements on page 14 regarding the MPCA staff not being used to dealing with farmers and perhaps interpreting agricultural exemptions in legislation as expressing a 'hands off' policy toward farmers are inaccurate and should be removed from the GEIS.

The language has been changed as recommended.

103. The statement on page 14 that state agencies have had conflicting views on how to deal with animal agricultural operations exaggerates the level of conflict that has actually existed between state agencies, and should be removed or better justified.

The authors believe the sentence to be an accurate statement.

104. The GEIS should note that the MPCA feedlot rules do allow for new technologies and in fact encourage producers to explore innovative technology; further, the GEIS should note that if an innovative technology comes into widespread, successful use, it may become possible to dispense with the special administrative procedures involved with innovative technology review by the MPCA.

The language has been changed as recommended.

105. On page 84 the GEIS incompletely and misleadingly states that MPCA rules do not allow for public review of feedlots less than 1,000 animal units. The public has opportunities to provide comment on such feedlots through environmental review and through the permitting process. Accordingly, the GEIS should:

a. Describe the public review and comment triggered by EQB environmental review rules;

b. Include language regarding the ability for public comment on NPDES permits for facilities that are CAFOs; facilities under 1,000 AU that are CAFOs may be required to obtain a permit that is placed on notice for public comment.

The GEIS section has been modified to acknowledge the possibility of public review through the mechanisms cited in the comment.

The GEIS does not purport to fully explain the MPCA-administered feedlot rules, Chapter 7020. It recognizes the technical expertise and knowledge of MPCA staff on these matters. We direct and encourage citizens to contact the agency for interpretation of these rules with regard to individual situations. An interested reader is encouraged to go to the MPCA Web site at http://www.pca.state.Minnesota.us/hot/feedlots/

106. The commenter feels it is inappropriate for governmental action to try to move the entire agricultural community in a direction that a small segment of the population (advocates of organic and certified products) deems appropriate; instead, choices of what products to buy should be left to the individual consumers, who have the ability to buy organic or certified products now if they wish.

NO RESPONSE NEEDED

107. Farmers are more than willing to invest in their operations for common-sense compliance that improves the environment. However, burdensome, one-size-fits-all regulations are taking a heavy toll on farm incomes and forcing farmers to increase size to spread those costs over more units of production. The unintended consequence of such regulations is the inability of small and medium-sized farmers to compete. Any ill-founded recommendations of the GEIS may be a driving force for future expansion of animal feedlots in Minnesota.

NO RESPONSE NEEDED

108. Minnesota should improve the enforcement of feedlot regulations. A good inspection program is a prerequisite to sound enforcement.

More rigorous enforcement of existing rules is probably the most critical single action necessary to improve the public perception of feedlot regulatory programs. In the public meetings there was a recurring sentiment that the MPCA and county feedlot officers need to do a better job inspecting facilities and enforcing the laws currently in place. As one person said, " Current policing of feedlots is totally inadequate, because some noncompliant facilities continue to violate existing regulations with impunity. All feedlots should be monitored on a regular basis to ensure that they are in compliance."

109. Units of government should form mediation boards to deal with these issues, rather than cases going directly into the courts.

See response to comment 81

110. This chapter and associated recommendations could speak more clearly about the role of government in promoting and providing information sets that help private and public decision makers make the best decisions. Examples include feedlot inventory data, digital soil survey data, soil nutrient data, demographic data, wind data, sinkhole probability maps, wellhead protection information and information about other special protection areas. Good information and early coordination are keys to avoiding permitting disputes and poor land use decisions for new and expanding livestock operations, as well as for fixing existing feedlot pollution problems. Geographic information systems can be powerful decision aids, if reliable data layers are available. The GEIS advanced this approach to providing data layers that project proposers and responsible government units for environmental review are unable, or unlikely, to develop for individual projects. More could be done in this regard, with priorities based on the value of different data sets for multiple uses, including feedlots.

The authors agree that one of the primary roles of government in feedlot regulation and environmental review should be the promotion and provision of the highest quality information available. Several of the policy recommendations from the Spatial Analysis/GIS TWP specifically address this point.

111. Land Management Information Center work with the Minnesota Pollution Control Agency and the Department of Agriculture to develop a statewide feedlot inventory database that is usable at both county and state level.

See response to comment 110.

Economic Impacts

112. Financial assistance and incentives need to be targeted to the small and medium size farmers to help preserve this way of life.

NO RESPONSE NEEDED

113. Economic and environmental externalities from feedlots need to be more completely addressed in the document.

The GEIS does incorporate the information on externalities that was developed by the GEIS contractors. We acknowledge that this information is less than had been hoped for, but it is information now available or could be developed within the time and resources constraints of the project. The CAC acknowledges the need for much more work on externalities if we are to truly understand the benefits and costs of animal agriculture in this state. The CAC acknowledges this in Theme # 2, and policy recommendations # 71 and 76, and to some extent, in # 59 and 64 all found in Appendix D of the Final GEIS.

114. Livestock business has a very positive economic impact on Minnesota businesses.

NO RESPONSE NEEDED

115. We must find ways to offer incentives and "Green Payments" to enhance the value of existing processing plants and support the livestock industry.

NO RESPONSE NEEDED

116. The section on external costs does not mention the spillover benefits of animal agriculture.

As pointed out in the introduction to the "External Costs and Benefits of Animal Agriculture" section (page 106 of the Public Review Draft) and explained in more detail in the Economics TWP, section V-3, and the Literature Summary, chapter F, the "spillover" portion of external costs and benefits is primarily pollution-type impacts which are generally considered to be the negative. Thus, one would not expect much treatment of positive benefits under the section on "spillovers." New information on the positive benefits of animal agriculture has been added to the GEIS, as described in response to a number of other comments on the lack of positive economic impact information.

117. There should be a cost-benefit analysis completed on any new regulations proposed to determine if the incremental protection is worth the price.

The authors agree that a cost-benefit analysis is a wise precaution for any policy recommendation being considered for implementation. Typically the Legislature and the various state agencies conduct this analysis as part of any new laws or rules they are seriously considering. EQB staff and the CAC considered it premature to conduct such analysis on policy recommendations, which may or may not withstand the scrutiny of the EQB members and ultimately the Minnesota Legislature.

118. The Economics section seems to emphasize only the negative aspects. There is no discussion of the positive economic impact of livestock production on the Minnesota economy.

Additional information providing this information has been added to the Economics and Description of Animal Agriculture sections of the proposed Final GEIS. The Minnesota Department of Agriculture has information on the economic impacts of various production systems for further reference.

119. Any codes of practice adopted must not put Minnesota producers at a competitive disadvantage. Practices in foreign countries are not feasible to implement here without altering the financial subsidies paid to Minnesota farmers.

NO RESPONSE NEEDED

120. Excessive regulation will drive livestock farming out of this state.

NO RESPONSE NEEDED

121. The Economics paper did not adequately discuss the importance of livestock production and products on Minnesota economy.

Additional information providing this information has been added to the Economics and Description of Animal Agriculture sections of the proposed Final GEIS.

122. The GEIS does not adequately describe and acknowledge the potential benefits of manure digester technology. Such systems are becoming popular as ways to minimize odor and air emissions, reduce manure needing land application, and generate revenue to the farmer through electricity production. The EPA, USDA, and DOE are supporting and promoting manure digestion through the AgSTAR program. Much has been done to study alternative technology in the agriculture industry, and this is not mentioned at all. The EPA completed a nation-wide study of the effectiveness and feasibility of the use of manure digesters of varying sizes on different types of farms across the country. One of these farms, the Haubenschild Dairy, is in Minnesota and is considered to be an extremely successful application of the system. More recently, an application for a dual-digester facility, Northern Plains Dairy, has been received by the PCA. While the GEIS has devoted only one sentence to this technology, farmers, legislators, and Xcel Energy have all been developing programs to help finance this technology for farmers in Minnesota. It is absolutely essential that the GEIS provide a more adequate and appropriate discussion regarding this technology.

There are a variety of ongoing agricultural technology research projects and improvements. The manure methane digesters are an important example. Detailed information on this project can be found be going to the Web site at http://www.Minnesotaproject.org/id5148.htm

Additional information on manure digesters has been added to the GEIS in the Soils and Manure chapter (on page 153 of the Public Review Draft), and reference to that information has been added in the Air Quality/Odor chapter.

123. Commenter noted the public is often confused about 'corporate farms,' which are illegal in Minnesota, and suggested that GEIS text clarify the restrictions on farm organizations applicable in Minnesota.

The text on page 96 and the table on page 111 of the draft GEIS document provide the clarification requested in this comment.

124. Farmers have turned to industrial-type production of livestock due to inadequate prices.

NO RESPONSE NEEDED

125. The Draft GEIS contains little positive information about the livestock industry in Minnesota. The GEIS is not complete without credence given to the economic value of the industry. If we did not have livestock, we would be a much poorer state.

NO RESPONSE NEEDED

126. The GEIS must recognize the significant positive economic impact of livestock on Minnesota. Livestock represents about one-half of cash farm receipts in Minnesota and consumes about two-thirds of the state's corn crop.

Additional economics information has been added to the Economics and Description of Animal Agriculture sections of the Final GEIS

127. The GEIS does not adequately address the economic contributions of all animal agriculture to Minnesota, such as jobs and new revenue within communities. Agriculture contributes nearly $8 billion annually to the Minnesota economy, of which about $4 billion is from livestock and poultry. Livestock also serves as the major close-to-home market for crop producers.

NO RESPONSE NEEDED

128. The GEIS does not take into account consumer spending behavior in demanding inexpensive products, which are predominantly purchased through the corporate chain-store supermarket structure. Consumer and marketing variables must be taken into account in relation to the expansion of animal facilities as they relate to vertical integration of our food system.

The chosen technical contractors for the economics work at the University of Minnesota did examine the various forces affecting animal agriculture, including consumer and retail marketing factors. Their discussion is presented in the Economics TWP in Chapter III, beginning on page III-6. A condensation of that information is provided in the GEIS Public Review Draft document beginning on page 102.

This comment seems to imply that consumer and marketing variables have a predominant influence on animal agriculture that the GEIS fails to acknowledge. The discussion of forces in the TWP, however, while it acknowledges these as factors at play in shaping modern animal agricultural production, does not portray consumer spending and retail marketing forces as the predominant ones. It is beyond the expertise and resources of the EQB at this point in the GEIS process to research this complex area any further. Readers interested in recent trends in consumer food retailing and how they may affect U.S. livestock producers may wish to read a recent report titled "Consolidation in Food Retailing and Dairy: Implications for Farmers and Consumers in a Global Food System," prepared for the National Farmers Union by the University of Missouri, and available for reading at the National Farmers Union Web site.

129. Commenter stated that for every person employed in agricultural production, seven more have jobs in processing, transporting, or marketing.

NO RESPONSE NEEDED

130. Expand the Minnesota Department of Agriculture's Energy and Sustainable Agriculture Program to provide more assistance through grants, loans, and clearinghouse of information on sustainable agriculture methods.

We received a number of comments pointing out that the document did not adequately deal with issues of sustainable livestock systems. Efforts were made to locate and include the requested information. The amount of information available on sustainable and alternative livestock systems was limited. The document was edited to include more of this information in the section on the Description of Animal Agriculture. There was a significant sentiment in the public meetings that the state needs to invest more research, education and marketing money to help promote sustainable systems. CAC policy recommendation #72, Appendix D, also addresses this concern.

131. Eliminate direct and indirect subsidies to feedlots and industry operatives.

NO RESPONSE NEEDED

132. The report does not include any reference to the importance of a strong processing sector in the viability of livestock production operations. Likewise, a strong livestock production system is crucial to maintaining and expanding processing businesses and the associated jobs. The implementation of policies that regulate animal agriculture will impact the supply of raw product to processors thereby having a negative impact on the viability of rural communities dependent upon agricultural processing. This will further erode population and sustainability of rural communities.

Additional information providing this information has been added to the Economics and the Description of Animal Agriculture sections of the proposed Final GEIS. The Minnesota Department of Agriculture has more information on economic impacts from various types of livestock facilities. An interested reader is encouraged to go to their Web site at http://www.mda.state.Minnesota.us/. The University of Minnesota Agricultural Economics Department discusses many of these concerns in the Economics TWP .

We do recognize the historical, social and economic importance of livestock agriculture to Minnesota. Agriculture has been, and continues to be, an integral part of the State of Minnesota. In fact, agriculture continues to contribute nearly $8 billion to our economy. The combined value of all livestock and poultry operations within Minnesota is around $4 billion. We also recognize the close linkage between crop production and livestock agriculture. Crop producers heavily depend upon livestock producers in providing them a close-to-home market, which is truly a value-added agricultural system.

Given the limited money and information that was available the GEIS could not adequately address the totality of economic contributions and relationships, such as jobs and new revenue within communities, that all livestock facilities have provided to rural areas of Minnesota. A more comprehensive investigation of the *economic factors involved in livestock production, processing, product marketing and retail, particularly discussing the issue of externalities, would be a high priority if additional money was made available to the project.*

Water Quality Issues

133. Livestock agriculture, especially dairy, in southeastern Minnesota has a positive environmentally impact by preventing the erosion associated with row cropping of the same areas.

Many farmers in southeast Minnesota claim that in this region the combined system of dairy and forage operations provides a better economic return and less erosion than a system of continuous cropping on the same land. Although no comparative earnings data was provided this observation seems intuitively correct based on all available background and supporting information.

134. A large portion of Minnesota is highly susceptible to surface and ground water pollution.

This comment is verified by detailed information in the Water Quality Technical Work Paper. There is a need to develop facility design standards to deal with unique regional hydrogeologic circumstances. This was already accomplished in the karst zone of the southeast by an MPCA-staff supported initiative.

135. Minnesota needs to get a handle on its land use so that it is not one of the major contributors to the hypoxia problem in the Gulf of Mexico.

NO RESPONSE NEEDED

136. Page 114 states that liquid manure applications cause a greater risk for nitrate leaching to tile drains than do surface applications of solid manure, especially if the liquid is injected; this is not a true statement due to the greater likelihood that, with solid manure, producers have less confidence in the nitrogen content of the manure getting to the crops, causing them to over-apply commercial fertilizer.

The authors believe that the statement in question is true to the best of our knowledge and understanding. The text on page 114 was quoted directly from page 110 of the Water Quality Technical Work Paper as submitted by the Soils Department of the University of Minnesota. The original text will remain in place unless the commenter can provide suitable contrary evidence for review and consideration by the EQB and the University of Minnesota.

137. The word "method" should be deleted in the third paragraph, third sentence, on page 114. Page 114 now states that the method of application does not affect risk of bacteria in surface water, but on pages 121 and 122 it that injection or incorporation leads to smaller risks than with other methods. MPCA staff believes the literature supports the statements of pages 121 &122.

The language has been changed as recommended.

138. The statement about MPCA ground water studies on page 115 should be changed to read "Much of the monitoring was conducted on coarse-textured soils," rather than indicate that "all" studies were done on such soils, since only two of the four studies were done on coarse-textured soils.

The language has been changed as recommended.

139. Commenter described a situation where two neighboring farmers allow 50-100 dairy cattle access to a recreational lake, contributing to pollution. Commenter supports GEIS water quality and land use policy recommendations.

NO RESPONSE NEEDED

140. Policy Recommendations #27 and #3l , Appendix D, address the same issue but use different numbers, Which is it? The CAC recommends (#27) requiring manure management plans at facilities with over 100 AU and later (#31) recommends that manure management plans be required at facilities between 50 and 300 AU. These recommendations should be made consistent.

This inconsistency in policy recommendations was overlooked. The authors suggest that the two CAC policy recommendations be combined and revised to create one consistent policy. We recommend that based on the findings of the Water Quality TWP, we accept the language of policy # 27, Appendix D, but use the numeric limit from policy #31, Appendix D. In addition, at one of the public meetings a request was made to restrict on-site manure management plan inspection to authorized individuals to prevent potential harassment of farmers. The authors intend to correct these inconsistencies by modifying the language, so the final recommendation approved by the EQB would read:

"*Require all facilities with greater than 50 animal units at any time during the year to prepare complete manure management plans, including an estimate of the quantity of manure generated annually and farm land potentially available for manure application at agronomic rates for the crops and soils present. A copy of these plans should be submitted to the designated feedlot authority and a copy should be kept on site and available for inspection by authorized regulatory officials upon request.*"

This new policy recommendation will replace CAC's # 27 and 31 and be placed in the Soils and Manure chapter of the Final GEIS document.

141. The "Water Quality" chapter "Surface Water" section contained a paragraph on the effects of hormones on surface waters in the CAC-reviewed draft. (The study found that soil and runoff concentrations of the potent sex hormones estradiol and testosterone increased with poultry litter applications.) This language has been deleted and is not shown as stricken in the final draft. The language should be reinstated.

This item was eliminated due to the fact that this topic was covered by one paragraph in the Water Quality TWP and the citation to the source article of the Journal of Environmental Quality given there for reference by a person truly interested in the topic. This material was determined to be too specialized and of limited interest to the more general reader. The language will not be reinserted into the Final GEIS document.

142. The authors show a clear bias to implicating present-day agricultural practices of fertilizer and manure management as significant causes of water quality degradation. They accomplished this by making invalid assumptions, using improper methodology and selectively referencing the literature. The results are recommendations that are not based on proven **cause and effect** relationships. The effect of implementing recommendations that are not based on proven cause and effect relationships is wasted public and private monies and possible increased water quality degradation.

In developing these GEIS documents, every possible attempt was made to include high quality, peer-reviewed material from recognized scientific and technical experts in many disciplines. Impartial experts were employed to objectively assess available information and derive conclusions that could be used to develop reasonable policies. CAC policy recommendations were all discussed in this light and crafted based on widespread consensus among the knowledgeable and diverse stakeholders on the CAC. While it is recognized that there are many contributing sources to water quality degradation, any well-informed person recognizes that excess nutrients from agricultural operations are a significant factor in causing the problem.

143. New language has been added following the CAC-reviewed draft in the "Water Quality" chapter, "Surface Water" section about how farmers "must have these drainage systems in order to produce crops in their land. The positive economic benefits of agricultural land drainage in Minnesota have been significant." These assertions may or may not be true, but they are not derived from the GEIS study findings, are not substantiated, are not related to impacts on surface water quality and should be deleted if not properly explained and substantiated.

The authors felt many readers might not be aware of the fundamental reason why so much Minnesota land is drained for agricultural production. Agricultural drainage is a potential source of water quality impairment, discussed in the Water Quality TWP. This background information is intended to more fully inform readers about the dilemmas involved in regulating this aspect of farming operations.

Air Quality Issues

144. Odors and dust from feedlot operations a causing a serious health threat to many individuals.

This comment is supported by the results of the Air Quality Technical Work Paper and the concerns are reflected in the GEIS document. Odors, air quality and related health effects are CAC priorities for additional research and regulatory program funding.

145. Until we have the science to accurately and economically measure whether complaints have merit or if any health threats are real, the whole process will be nothing but unlimited confusion, frustration and litigation.

NO RESPONSE NEEDED

146. Right-to-farm laws do not protect farmers who expand and thereby cause nuisance problems for their neighbors; thus farmers must carefully plan their expansions, using tools such as OFFSET, to be compatible with their neighborhoods.

NO RESPONSE NEEDED

147. Commenter related experiences with air quality/odor problems from a nearby large hog feedlot with a concrete manure tank. Commenter feels that governmental units were unresponsive to citizens' legitimate concerns regarding odors. Commenter questions whether it is wise to continue to develop large feedlot operations in light of problems of air quality, neighborhood conflicts, and overproduction. If government subsidies were withdrawn, production would fall, prices rise and smaller diversified farms would be more viable. Believes agricultural commodity groups resist solving problems and instead rely on political muscle to avoid regulation.

NO RESPONSE NEEDED

148. For air quality and odor problems, it is crucial to get on-site and field-validate the situation. Computer modeling in an office on a computer screen cannot substitute for "air truthing" and testing on-site. If complaints occur, get out of the office and on-site. This is as important as notifying the facility owner that a complaint has been received. Because this is difficult, I strongly support recommendation #15 that facilitates and encourages independent standardized third-party evaluations and recommendation #21 to improve enforcement against long-term non-compliant facilities.

Improvements in the odor complaint tracking and response system are needed to increase citizen confidence that the MPCA and county feedlot officers are adequately enforcing environmental and public health regulations at feedlots.

149. The state must at least measure (not model) hydrogen sulfide and ammonia downwind from feedlot facilities, and enforce health limits based on children's health risks. Children are at a greater risk of brain damage due to hydrogen sulfide exposure. On page 109 in the air quality section it says, "Odors and dust from feedlot operations are causing a serious health threat to many individuals." This comment is supported by the results of the Air Quality Technical Work Paper and the concerns are reflected in the GEIS document. As reported on page 174, Research shows that nasal irritation can elevate adrenaline, which can convert mild annoyance to irritability, tension, and anger.

NO RESPONSE NEEDED

150. New language has been inserted in the "Air Quality and Odor" chapter, section titled "Use of Air Dispersion Models in Environmental Review of Feedlots." Several claims are made: 1) The high cost of air dispersion modeling (GEIS found that this cost is now quite reasonable); 2) Emission factors in use are not adequately tested (no such finding appears in the Technical Work Paper or prior GEIS drafts); and 3) Modeling may be perceived as hampering feedlot expansion in Minnesota (no such findings in earlier GEIS drafts or TWP, contrary findings in Role of Government). Delete this language or substantiate it with facts.

The language in the air quality and odor section of the proposed final GEIS was based on remarks made during public meetings on the draft GEIS and in discussions with MPCA air quality staff. The remarks are properly qualified as in: "Some people feel …, A number of producers believe… etc." The authors believe the remarks accurately reflect the testimony and information they were given. This language will remain in the Final GEIS.

Soils and Manure Issues

151. Prohibiting manure land application in winter will put small farmers out of business.

NO RESPONSE NEEDED

152. The Phosphorus Index for manure usage is an excellent idea.

NO RESPONSE NEEDED

153. Most people are not aware of the quantities and strength of the waste products generated by livestock.

NO RESPONSE NEEDED

154. The Phosphorus Index is an excellent idea.

NO RESPONSE NEEDED

155. The GEIS does not generally acknowledge that MPCA feedlot rules have phosphorus-based manure rate requirements in areas with a higher risk of polluting waters; no mention is made anywhere that P build-up is prohibited in high risk areas.

The new feedlot rules prohibit the application of manure in "special protection areas" in such a way that it soil phosphorus builds up beyond specified limits. Special protection areas are basically lands within 300 feet of protected waters, protected wetlands, and intermittent streams and most ditches identified on USGS quadrangle maps. An appropriate modification has been made in the text on page 150 of the Proposed Final GEIS.

156. Livestock manure is a valuable resource for crop production. A better understanding and recognition of the sustainable cycle exemplified by production agriculture is important to the future of our rural communities and ultimately, the well-being of all citizens. Consumer choice and future sustainability require that we recognize that livestock produce valuable food products and plant food for use in crop production. Research, education and incentives ought to work toward better management of all resources on all farms.

NO RESPONSE NEEDED

157. The GEIS should include estimates of the nutrient "carrying capacity" for all agricultural lands in Minnesota, and based on that information, maps of all counties indicating the fraction of the carrying capacity now used up by the current livestock production.

The EQB agrees that the nutrient carrying capacity concept could be a valuable tool for feedlot management and the planning and siting of new feedlot facilities. Earlier in the GEIS process it was hoped that analysis of nutrient carrying capacities could be done. However, this project turned out to be beyond available resources. EQB and LMIC are currently undertaking a pilot project to see if spatial analysis of feedlot inventory data, with county soil survey information, and manure management plan information can be used to calculate the carrying capacity of a region in terms of land economically available for feedlot manure application.

158. Commercial fertilizer is an expense to the farmer when growing a crop. To use more than what is actually needed only increases the cost to the farmer and lowers his profit. On the other hand, manure has been considered by many as a waste which needs to be disposed.

One of the great dilemma's of animal agriculture is the management of manure. Manure is both a waste product creating disposal problems and a resource material with primary value as a nitrogen and phosphorus fertilizer and secondary value as a source of micronutrients and organic matter. Manure is a bulky material with an unbalanced nutrient ratio. It can present a number of operational and management problems, yet it is produced at a nearly constant rate by animals and it generates odors that can result in a nuisance condition. The bulk of feedlot regulation revolves around dealing with manure. Chemical fertilizer has the primary nutrient values with little of the secondary micronutrient and no organic matter. It is less bulky, nonodorous and relatively easy to handle and apply. It is produced only when needed by the farmer, so there is no significant storage problem. There is far less stringent regulation of the material. Given the opportunity to choose between these largely substitutable materials many farmers chose the chemical fertilizer.

159. Commenter notes that although the GEIS recommendations do not directly state it, it appears that the CAC would like to regulate the use of commercial fertilizer.

The CAC has chosen by its own ground rules to operate by a consensus process. Therefore, the CAC as a body has taken positions only on those matters on which it has reached unanimous agreement. The issue of commercial fertilizer has come up in discussions of overall nutrient strategies. There is little doubt that over-application of commercial fertilizer or application to inappropriate soils or locations could cause many of the same water pollution problems as the similar *misuse of manure. From a practical perspective, since the farmer pays for chemical fertilizer, common sense would normally dictate that they would be less likely to over-apply this material compared with manure that is usually free or available at a relatively low handling cost. Also because manure is a bulky material there is a strong tendency to apply it as close as possible to the point of generation. This imperative often results in manure being applied to land at rates in excess of the crop nutrient need, primarily to minimize manure hauling time, distance and cost.*

160. Local Soil and Water Conservation District capability for technical assistance needs to be greatly increased, or farmers should be provided with better economic information to justify expenditures on private sector expertise. Government technical assistance and training are insufficient methods to provide farmers with the ability to develop their plans and adjust their plans prior to each cropping year. Farmers are reluctant to hire private sector agronomists due to the costs and sometimes due to minimal availability of experienced experts on this subject.

The CAC recognized the validity of this comment. The group strongly supported increasing the availability of low or no-cost technical assistance to feedlot operators. This is reflected in CAC policy recommendations # 24, 34, and 35, found in Appendix D.

161. The state and federal governments should remain committed to the feedlot strategies put forth in recent years via rule and other documentation, by strongly supporting targeted technical and financial assistance for feedlot pollution abatement and improved nutrient management.

The 1999 USDA/EPA Unified National Strategy for Animal Feeding Operations and current Minnesota Feedlot Rules define timelines for meeting water quality standards and improving manure nutrient management. The federal Environmental Quality Incentive Program (EQIP) and the state Feedlot Water Quality Management Cost-Share, Nonpoint Engineering Assistance and Ag Best Management Practices Loan Programs are key to helping solve existing manure storage, feedlot runoff and land application problems. These programs give priority to feedlots with less than 500 animal units and the greatest environmental benefit potential, and consider local water plan priorities. Many small to mid-size feedlots have been identified as having substantial pollution potential. Federal and state funding for these programs in Minnesota should reflect a commitment to current feedlot pollution abatement strategies and water quality requirements, including the important engineering assistance role of Soil and Water Conservation Districts for feedlot fix-up investigation, design and construction inspection.

162. Feedlot inventory guidance should be updated to promote high quality Level 3 inventories, using current database technology, to better enable local and statewide definition of environmental conditions and needs related to feedlots.

The GEIS has identified the need for compatible, high quality feedlot inventories to better define needs and target resources for protection and improvement of water, soil and air quality associated with feedlots. Existing feedlot inventory guidance is outdated in regard to use of current technology. Level 3 inventories, which include definition of feedlot pollution potential using the Feedlot Evaluation Model, are used for targeting of technical and financial assistance programs. Current Web-based technology might offer good value to local and state government units for feedlot inventories. A Web-based feedlot registration and permitting system being developed through Nicollet County should be investigated as a possible model.

As part of the current Animal Agriculture GEIS project the EQB is engaged in a pilot project using LMIC's feedlot inventory and MPCA's feedlot registration data to improve spatial analysis of feedlot data. Discussions are also underway with the Department of Agriculture to see if feedlot inventory data can be used with the new feedlot rules to try and designate "livestock friendly zones" where we would anticipate the minimal environmental and demographic difficulties in locating new feedlot projects. EQB is using existing Level 3 inventories to demonstrate the power of spatial analysis.

163. Continue the development and maintenance of GIS data layers, and other monitoring and decision tools, which are critical for good siting, expansion and operation of feedlots, including sustainable land application of manure.

As mentioned in the response to the previous comment the objectives of this GEIS include enabling improved feedlot project reviews and land use decisions, and improved evaluation of cumulative impacts of feedlots. Reliable information, good planning and evaluation tools and early coordination are keys to timely and effective land use and manure management decisions. The GEIS advanced the use of GIS tools for effective feedlot decision-making. It also identified the need to further develop and utilize the Minnesota Phosphorus Index, Minnesota Nutrient Management Planning software, Feedlot Evaluation Model, air quality decision tools, and the definition of sensitive ground water and surface water areas. Digital soil survey data, and digital sinkhole probability maps for the karst region of Minnesota, are examples of other data sets that can substantially assist feedlot and manure management planning.

CAC policy recommendations # 36 and 38, found in Appendix D, addresses the need for BWSR to update and expand the FLEVAL model to include the land application of manure and to make this tool more user-friendly. A Web-based version of the Feedlot Evaluation Model would help address compatibility with different user operating systems. The federal, state, local and private partnerships that have evolved in Minnesota for improved nutrient management (e.g. refined University of Minnesota manure application recommendations, improved nutrient management planning tools, and education for livestock producers, public and *private technical assistance providers and manure applicators) should continue to be supported by federal and state programs, producer groups and others. These efforts should include application of current technology to monitoring and reporting of environmental outcomes.*

164. University of Minnesota Extension Service should help facilitate self-demonstration of various manure rates so that farmers can develop confidence in these rates. Manure management plans must be useful for the producer. All too often they sit on shelves after meeting a government-instituted requirement, thereby providing no environmental or economic advantage. Farmers need to develop confidence in the nutrient rate recommendations made in the plan. Farmers tend to believe results clearly substantiated on their own land. Farmers should be consulted about other ways to make the manure management plans more meaningful. This effort should include further research and demonstration on how to apply manure at low rates (e.g. 1,500 to 3,000 gallons per acre). Equipment is sometimes not available to apply manure at the rates or ways suggested in a farmer's manure management plan.

CAC policy recommendations # 34,directly and 35, 37 and 43,indirectly, all found in Appendix D, talk about the need for increased research targeted at optimizing the utilization of manure nutrients through explorations of timing, rates and technologies of manure land application. They encourage the continuation and expansion of federal, state, local and private partnerships that have evolved for improved nutrient management and education for livestock producers, public and private technical assistance providers and manure applicators) should continue to be supported by federal and state programs, producer groups and others. These efforts should include application of current technology to monitoring and reporting of environmental outcomes.

165. The University of Minnesota's Manure Application Planner software needs major revisions, updates and ongoing technical support. This software is a computer program for developing a manure management plan that includes an economic optimizer. It is important for government to invest in such tools to help farmers identify savings in commercial fertilizer costs when applying manure on their fields.

Since many additional farmers are now required to file manure management plans with the MPCA or county feedlot officers, one beneficial use of research money would be to provide a research grant to update and prepare an improved version of the Minnesota's Manure Application Planner software. This product should be distributed and staff support provided through the University Extension system.

166. Many of the recommendations relate to programs administered by BWSR, MDA, USDA and MPCA. These programs may be administered by these agencies, but they do not have the staff or the money to implement them. In Minnesota there are over 800 Certified Crop Advisers located throughout the state who could implement these programs without the addition of more staff at the agency level. We suggest adding wording to allow cost sharing for implementation of nutrient management practices coordinated through Certified Crop Advisers or other approved third party groups.

The EQB was not aware of the availability and expertise of the Certified Crop Advisers. To the extent that these professionals can assist Minnesota farmers in complying with provisions of state and federal rules on manure management, we would endorse the idea of reimbursing the cost of eligible services through cost-share monies.

167. Use and enforce the existing biosolids heavy metal standards for manure.

A great deal of medical, toxicological and environmental research was conducted in the 1970s and 1980s on the use of biosolids (then called sewage sludge) for crop production. The annual and cumulative limits for heavy metal loading for different soils and crops would be an excellent precaution to use in restricting manure application limits to low-risk agronomic rates.

Many metal-containing compounds are added to animal feed, often in the form of antimicrobials to improve animal health. Most of these metals are essential nutrients that can be toxic at high concentrations. A non-nutrient element, arsenic, is common in poultry diets. These elements are excreted in manure and could potentially pose a risk to human health if they are transported in excessive amounts to surface water or ground water from manure-amended soils. In addition, some metals are known to bioaccumulate in fish. This is a significant health risk for those who rely on native fisheries for a significant portion of their dietary protein.

The only major complication with this recommendation is that unlike biosolids, animal manure is rarely, if ever, tested for the heavy metals of concern. Farmers would be likely to resist a new requirement for periodic chemical testing of their manure. In cases where the analysis information exists we would strongly advise using this suggested precaution.

Human Health Issues

168. There are major concerns about the subtherapeutic use of antibiotics as a growth promoter in animal feed. The problem of antibiotic resistance is becoming a major concern in pediatric medicine. The subtherapeutic use of antibiotics in animal feed needs to be banned as soon as possible. Antibiotic resistance is a much more important issue than originally realized and the EQB needs to take a stronger stance on this issue.

This issue has emerged as increasingly important since the original scope of work for the GEIS was developed. The problem of antibiotic resistance in children is a special concern to public health professionals. The complexities of cost-benefit analysis and risk assessment are most pronounced for this topic. The CAC made an original policy recommendation on this item that was seen as weak by the public in light of recent information. The New England Journal of Medicine devoted one-half of its October 18, 2001 issue to this topic. The EQB may have to reconsider the original recommendation of CAC in light of the new information coming from medical research. The text in the Human Health section has been updated with additional recent information on the issue of antibiotic resistance.

169. The commenter believes that certain organic chemicals and pharmaceuticals used in animal production are moving into the environment causing significant disruption of mammalian endocrine systems.

NO RESPONSE NEEDED

170. We need to take a much stronger stance against subtherapeutic antibiotic use in farm animals and the possibility of terrorists using biological warfare after the events of September 11, 2001.

NO RESPONSE NEEDED

171. Concern about worker safety problems in animal production and processing facilities.

The GEIS presents information on worker safety in production facilities but not processing facilities. The Scoping Document, Topic K, Human Health, limited the types of worker health effects that would be dealt with in this study. Additional information is provided in the Literature Summary, beginning on page K-14.

172. The GEIS should include further information on the important subject of antibiotic use in livestock production and its relationship to the environment.

Antibiotic resistance is an emerging public health crisis facing the 21st Century on a global level. Many antibiotics are losing their effectiveness as target bacteria evolve resistance. The evidence of antibiotic abuse in the agricultural sector is already manifesting within our food production processes. Strains of salmonella and other disease-causing organisms found in raw and undercooked meat are increasingly resistant to several antibiotics. This is also a concern as bacteria can transfer resistance genes to unrelated species. The MPCA staff has reviewed technical literature that indicates that antibiotics are transported into surface and ground water in areas with feedlots and that land application of manure could introduce pharmaceuticals in surface and ground waters. The ongoing release of livestock wastes means that even readily degraded antibiotics act as persistent contaminants in the environment.

The GEIS has been modified to add additional text under Scoping Question 2 of the Human Health Chapter. The CAC would support this as a priority for research funding and regulatory action.

173. The State of Minnesota should prohibit the use of antibiotics except to treat disease and disseminate information on probiotics. On page 81 "The most promising area for reducing the rate of development of microbial resistance to antimicrobials is in the use of competitive bacteria added to feed to promote the growth of normal bacteria and exclude pathogenic bacteria in food animals. These agents, called probiotics, will most likely see a significant increase in use over the next ten years, and may replace some of the nutritional uses of antimicrobial agents."

The authors do not believe that there is sufficient information to justify a blanket prohibition of all subtherapeutic use of antibiotics in animal feed at this time. The CAC policy recommendation is consistent with the federal approach advocated by FDA. In evaluating the recent findings of Minnesota Health Department researchers on prevalence of Campylobacter infection in Minnesota , actions of the American Medical Association and the American Public Health Association, the European Union approach to this issue and the actions of the World Health Organization, EQB staff recommends the addition of a policy recommendation which discourages routine feeding of antibiotics to healthy farm animals, prohibits the use in subtherapeutic animal feeding of any new human antibiotics developed in the future, plus imposes an immediate ban from animal feed of any existing human antibiotics which are determined by a qualified group of medical experts, such as the American Medical Association, to be critical to reserve exclusively for human disease treatment.

On the issue of probiotics, the authors believe that there is not enough peer-reviewed information available on the subject and insufficient field-testing to justify a statewide endorsement of the technology at this time. Although this class *of chemicals may have great promise, more data is needed to establish the efficacy and risk-benefit ratio of this technique.*

174. In relation to concerns over human health, we believe the GEIS is overreaching in its ability to adequately assess the issues. The federal government, namely the Environmental Protection Agency, Food and Drug Administration and Health and Human Services, devote significant time and resources to deal with risk assessment as it relates to antibiotics, hormones, chemical residue and drinking water. We feel the Minnesota Department of Health does not have adequate resources to deal with these issues, and policy recommendations from state agencies will be at risk of being non-scientific, based on emotion and focusing too narrowly on segments of agriculture that segments of society deem controversial.

Human health issues are such a major concern that coordinated actions among state, federal and international authorities is required to regulate facilities, inspect products, and conduct needed medical, environmental and public health research. The Minnesota Department of Health (MDH) does not have adequate resources to do this task alone. However MDH has conducted very important pioneering work in aspects of the many public health problems associated with livestock facilities and products. Their work in epidemiology is nationally recognized as outstanding.

Animal Health and Welfare

175. Support instituting humane codes of practice to foster improved animal welfare. (twenty-eight almost identical responses received in this area)

The CAC did exactly this in policy recommendation #65, Appendix D.

176. Systematic neglect and horrific cruelty is commonplace in the production, transport and slaughter of food animals in Minnesota.

There is substantial public concern on this issue. This topic received the greatest number of oral and written comments. The GEIS has dealt with it briefly. The Animal Health and Well-Being Technical Work Paper provides additional detail to the interested reader. The CAC considered these questions at their meetings, and unanimously passed four fundamental policy recommendations, #'s 65 to 68, all found in Appendix D.

177. The disposal of animal carcasses should be discussed at some length.

The GEIS, and the technical reports it has been extracted from, do not specifically deal with disposal practices for carcasses, nor does the Scoping Document call *for this specific information. The GEIS, Human Health TWP, and chapter K of the Literature Summary do discuss the general principles of transmission mechanisms through soil, water, and air from all types of potential sources associated with livestock farming, including animal carcasses, in response to the Scoping Study Question (K.2.c) inquiring about the health risks from transmission of disease organisms from livestock farms. Additional information on this topic is available from the Board of Animal Health.*

178. Feedlots are concentration camps for animals. They are hideous.

NO RESPONSE NEEDED

179. Let us stop treating farmed animals as production units and phase out the cruelties of confinement systems.

NO RESPONSE NEEDED

180. Animal welfare recommendations are best left to experts in animal health care based on their scientific knowledge and professional expertise.

There was a substantial minority of commenters who expressed the opinion that the claims of animal welfare activists were exaggerated, based on a few isolated incidents portrayed as if these were standard operating procedure in livestock production.

181. Any less than desirable treatment to an animal reflects on us and is added burden to the debt humanity has to bear; we must see that they are treated with kindness and respect.

NO RESPONSE NEEDED

182. The commenter cites a recent book on antibiotic use in livestock that indicates that 70 percent of antibiotics in use in the U.S. are used subtherapeutically in livestock. As a physician, commenter has observed the ongoing emergence of antibiotic resistance in bacteria. The European experience after banning subtherapeutic use was that it did not lead to increased infection rates or economic hardships.

The issue of antibiotic resistance and new information regarding it was referred to the CAC for reconsideration of its recommendation. The CAC considered the question at their final meeting in November 2001, and declined the opportunity to pass any additional policy recommendations on this topic. Please see the response to comment # 173 for additional discussion.

183. Commenter appreciates GEIS's recognition of need for humane farming standards and fact that GEIS has heeded public concern over the lack of such standards.

NO RESPONSE NEEDED

184. Commenter endorses the importance of the eight themes stated on pages 15 to 17, especially theme 6. However, commenter is puzzled by theme 3, "Human health before animal welfare." Theme seems to imply that animal welfare could sometimes be detrimental to human health. Suggests rewording as: "Human health and animal welfare are compatible;" or "Promotion of human health, aided by promotion of animal health."

The text about important themes is derived from discussion that took place among the CAC members as they prioritized their areas of concern, so we do not feel comfortable changing words as spoken. We did not anticipate your specific interpretation of the statement. We feel the themes enumerated on page 16 relating to animal welfare do answer the concerns expressed in the final sentence of your comment.

185. There should be a brief summary of applicable federal and state regulations on animal health and welfare.

A summary of state and federal regulatory programs relevant to animal health and well-being are included in both the Literature Summary and the Animal Health and Well-being TWP.

186. More of the Animal Health and Well-being TWP should be incorporated into the GEIS chapter, as the existing chapter is unbalanced in favor of the industry viewpoint. This chapter should be less of a defense of what we now do and more a description of what we are striving for.

The chapter is being revised as suggested. Integrating the Animal Health chapter of the Literature Summary and the Animal Health and Well-being TWP into one section of the proposed Final GEIS was a significant challenge. An interested reader should refer to both source documents and the references for a more complete discussion of all aspects of the issues. The authors of this section spent a great deal of time trying to find a balance of information from widely conflicting viewpoints without overwhelming the more casual reader with excessive data.

187. The GEIS, on page 179, states that it is a premise of producers that high levels of productivity and absence of diagnosable morbidity are sufficient evidence of animal health and well-being. The GEIS does not challenge or comment upon this statement even though the commenter understands that there is a significantly higher death rate in confinement facilities than in conventional operations.

Throughout the GEIS, persons with special technical expertise will observe, present data and draw conclusions based on their experience in the industry of livestock production. In most cases, the GEIS seeks to present the information as received without challenging the source. This information was given to CAC members, some of whom were experts in livestock production and it was discussed at length. The CAC also had the opportunity to revise the earlier drafts of the document. They chose not to modify this item.

In the policy recommendations section Appendix D, CAC members explored how they might change the current situation to achieve their objectives. Here you will find policy recommendations # 65 to 68 that deal with the concerns expressed in your comment. There was no data about comparative mortality rates among various livestock production systems presented for review by the commenter.

188. On page ii, section L, "well-being" is missing from the topic title.

The language has been changed as recommended.

189. The most notable aspect of the animal health and well-being topic of the GEIS is that no animal welfare-interests, not even a veterinarian, was appointed to the CAC. That fact and the CAC's recommendation-by-consensus ground rule resulted in the vast majority of possible recommendations about animal welfare being excluded from the GEIS.

Although it is true that no CAC member was associated with the animal health or welfare area by background, several members spoke out repeatedly about the need to give serious consideration to this topic. Some members of CAC could be characterized as strongly supportive of increased focus on animal welfare issues. In addition, the CAC as a whole chose a well-known animal welfare advocate to prepare the Animal Health and Well-being TWP to provide balance on this issue.

The CAC's consensus ground rule resulted in many potentially controversial policy recommendations for every topic being excluded from the GEIS; that result is not peculiar to the animal health and well-being topic. All policy recommendations are founded on the premise that decision-makers will pay heed to recommendations supported, or at least accepted, by diverse interests. Said another way, the GEIS is based on the premise that a "weaker" recommendation with broad support is better than a "stronger" recommendation with narrow support.

190. Animal transport and slaughter are not explicitly mentioned in recommendations 65 to 68, despite the fact that many severe problems for welfare occur in these processes. For example, we know that even existing legislation such as the Humane Slaughter Act is not fully applied. We suggest that one or more additional recommendations should be made stressing the critical importance of these issues, based on Halverson's suggestions.

The CAC was made aware of the particular problems associated with animal cruelty during transport and slaughter. They did not choose to address this issue.

191. The very few animal welfare topic recommendations that have made it into the GEIS Draft version, have also been significantly weakened, to the point of being completely toothless and unenforceable. No recommendations were even included, that would deal with the already chronic problem of current laws and guidelines going un-enforced. The overall CAC structure has been instrumental in preventing any real addressing of the on-going animal welfare problems that Minnesota animal agricultural has been now mired in for years. I implore the CAC and the EQB to put the dropped animal welfare recommendations back into the GEIS, and to word them so that they are enforceable, and therefore, of any use to resolving current problems.

NO RESPONSE NEEDED

192. We have a window of opportunity, long awaited by compassionate citizens and desperately needed by the animals languishing inside animal factories, to do something meaningful in Minnesota. Please do not waste the substantive Technical Working Paper on Farm Animal Health and Well-being by Marlene Halverson and the team of international expert scientists she assembled. Please do not gloss over the truth about the impact of 25 years of industrializing the raising of sentient creatures. The animals cannot organize and cannot lobby. It is up to us whether they continue to suffer or not.

In addition to the recommendations already included in the document, we respectfully urge you to include the following additional provisions, taken from the technical working paper on Farm Animal Health and Well-being submitted by Marlene K. Halverson:

Recommendation 1: Farm animals are sentient beings and caretakers and animal production systems shall take into account their basic biological and behavioral needs in construction, operation and management.

Recommendation 2: Animals shall be accorded freedom from fear, hunger, thirst, pain, and discomfort and the freedom to express normal patterns of behavior.

Recommendation 3: Farm animals must be humanely slaughtered and transported.

Recommendation 4: Farm animals shall be accorded freedom to perform natural physical movement and to associate with other animals.

Recommendation 6: Farm animals have a right to humane transport. The transport of downed or disabled livestock should be prohibited.

Recommendation 11: Institute the phase-out of gestation crates and battery cages.

Recommendation 16: Create division within Minnesota Board of Animal Health to enforce regulations regarding health and well-being of individual animals on farms.

Again, on behalf of our Minnesota members, we urge you to help ensure that farm animals in your state do not continue to suffer through the intense confinement, overcrowding, filthy conditions, and painful procedures that dominate today's industry by including the aforementioned recommendations in the final version of the GEIS. We also urge the board to represent growing consumer concerns about preventing inhumane treatment of animals used in agriculture by including an expert on animal welfare issues on any future Citizen Advisory Committee.

This is a very complex and emotional issue. the CAC debated the matter and did make several policy recommendations to improve the situation. It is obvious from the number and tone of the comments on animal well-being that this issue is a significant concern . The CAC compromised on a limited number of the eighteen recommendations suggested by Marlene Halverson.

193. Humane codes of practice for animals should neither be established nor subsequently legislated. The biomedical laboratory animal research industry has just gone full circle on standards for laboratory animal housing and care. The industry has abandoned the initial set of engineering codes and replaced them with performance standards ("Guide for the Care and Use of Laboratory Animals" National Research Council, 1996). Laboratory animal research has proven that the code standards inferred by human intuition had little to no value to the well-being of animals. Farm animals used in research have their own animal welfare guidelines (USDA APHIS Animal Welfare; Farm Animals Used for Nonagricultural Purposes, Fed. Reg. 65[23] Feb. 3, 2000). As appropriate, this guide is intended only as a guide. It represents the most current thinking on appropriate practices for the handling, care, treatment, and transportation of farm animals used for nonagricultural purposes. The guide contents are widely practiced by common sense on modern livestock farms. They are common knowledge.

NO RESPONSE NEEDED

194. Is this material from Minnesota statutes included in the GEIS?

343.21 Overworking or mistreating animals; penalty.

Subdivision 1. Torture. No person shall overdrive, overload, torture, cruelly beat, neglect, or unjustifiably injure, maim, mutilate, or kill any animal, or cruelly work any animal when it is unfit for labor, whether it belongs to that person or to another person.

Subd. 2.Nourishment: shelter. No person shall deprive any animal over which the person has charge or control of necessary food, water, or shelter.

Subd. 3. Enclosure. No person shall keep any cow or other animal in any enclosure without providing wholesome exercise and change of air.

These animal cruelty laws are referred to and discussed specifically in the Animal Health Chapter of the Literature Summary and also in the Animal Health and Well-Being TWP. Essentially, deliberate cruelty to farm animals in Minnesota is illegal, much like it would be for household pets. It is questionable how vigorously this law is enforced in actual practice.

Appendix B2

Summary of Oral Comments received at Draft GEIS Public Meetings

The purpose of this appendix is to briefly summarize the main ideas presented in the public comment meetings held on the draft GEIS during August and September 2001. In many cases, persons who testified personally also submitted written remarks that may be found in Appendix B1 immediately before this section. This appendix is intended to give the reader some idea of the issues of concern expressed at the various public meetings. EQB staff attempted to capture the main idea or ideas expressed by the individual speakers in the bulleted items. These bullets are grouped by meeting location. No attempt is made in this Appendix to answer all these concerns. We feel the supporting text and the previous appendix do provide EQB staff response to many of the questions posed at these public meetings. Copies of the taped meetings are available for public review.

GEIS Public Comments

Marshall, MN

a. Summarize the Human Health TWP findings

b. Criticism of MPCA enforcement program

c. Support certification program for feedlots as done by EPA & MDA

d. Support for labeling of certified facilities

e. Expand the MNCERT program for pork to other species

f. How do other US states compare to Minnesota in the collection of information?
    1. Can these regulations hurt Minnesota's competitiveness?

g. What is being done to protect farmer's data privacy?

h. What kind of follow-up or actions are expected from GEIS?

i. What will the Minnesota Legislature do with this report?

j. Can these proposed policy recommendations be changed by CAC, EQB?

k. The GEIS does not adequately discuss sustainable animal agriculture.

l. MDA and U of M are avoiding funding alternative systems, funding is limited.

m. Investigate livestock ownership patterns to follow the money. (Rep. Winter)

n. What is being done to require uniform zoning codes in TWP and counties?

o. What is the MPCA doing with EPA's changes to feedlot rules?

p. Have you studied human health effects around feedlots?, cluster studies?

q. Will Minnesota taxpayers research benefit other states beyond us?

r. You must calculate external costs of livestock, energy and water quality.

s. Agriculture involves commerce between willing parties.

t. Stress the importance of air quality issues (small and large facilities).

u. What about economic interaction of producers and processors?

v. Water quality problems are caused both by manure and chemical nutrients.

w. What happens on September 14, when GEIS public comments close?

x. Are all the GEIS recommendations based on scientific facts?

y. What is the quality of MPCA's compliance and enforcement program for feedlots?

z. Stress the importance of manure nutrients to crop production.

Fergus Falls

a. Are you aware of recent environmental problems with feedlots in North Carolina and Texas?

b. Stress importance of agricultural energy concerns and emerging technologies, such as Haubenschild manure digesters.

c. How are existing feedlot permits going to be changed by new rules?

d. How can you justify using old 1997 data in the GEIS?

e. How can you use statewide analysis of feedlots , when regions have big differences?

f. Conflicts come from non-farm residents on rural land vs. right to farm laws.

g. It is critically important that we are enforcing regulations.

h. Farmers should be allowed to use their land without undue interference.

i. Environmental activists delay business by asking impossible/expensive questions.

j. Appropriateness of controlling local land use at proper level of government.

k. Who will have the final say in this document and recommendations?

l. What definition of animal units are you using?

m. What weight is given to complaints, esp. anonymous complaints?

n. Enforcement may follow a complaint, is not the result of complaints (MPCA rep.)

o. What is better a few large feedlots or many small ones?

p. Importance of keeping an open mind to new technologies.

q. What is the best level of government to regulate feedlots?

r. MPCA supports have feedlot regulation done at the county level.

s. Concerns about feedlot contamination of groundwater in outwash deposits.

t. Discussion of laundry list of land use and zoning tools in Policy Recc.# 47 a-j.

u. GEIS tends to give little coverage to some very important topics.

v. Do you think these recommendations will reduce water quality pollution in the Mississippi River?

w. Why are chemical fertilizers not given equal treatment to manure?

x. Is there effort to look at cropland like livestock?

y. Who identifies the priorities and when will the public see these?

z. Need to advocate for public funding of livestock agriculture research.

aa. Have you looked at Echinacea as a growth promotant?

bb. Was a moratorium considered on large feedlots?

cc. At what stages of regulation is it most appropriate to intervene?

Thief River Falls

a. What is going on with Anthrax in NW MN?

b. Insurance payments are made for Anthrax, can state pay additional damages.

c. HACCP program for food safety mentioned for emphasis.

d. Committee needs to prioritize all these recommendations .

e. Economics is most important driver of livestock agriculture.

f. How was Scoping Document prepared?

g. You need to know the economic impacts of any decision you make.

h. Turkey Growers in NW MN formed a COOP to survive economic changes.

i. Public comment period is too short, meetings are poorly timed.

j. With new feedlot rules just passed, now will GEIS help?

k. MN Dairy is in trouble, excessive regulation will hurt us..

l. MN Dairy industry is developing a product certification program.

m. Legislature needs to recognize producers have special economic problems.

n. Who is going to pay for all this environmental regulation?

o. We must consider the positive economic impacts of livestock agriculture.

p. FLEVAL was never designed to evaluate pollution potential from feedlots.

q. Footnotes should be provided to define unfamiliar terms, OFFSET, FLEVAL.

r. Appreciation to CAC for all their hard work.

s. Base recommendations on sound science, esp. antibiotic use bans.

t. Must do a cost-benefit analysis of the impact of all policy recommendations

u. Cost-benefit analysis must be expanded to include local retail and industry.

v. Livestock agriculture is a very low profit industry.

w. Working farmers are good stewards of the land and care about their stock.

x. American farmers cannot compete with Brazil.

y. We need a level economic playing field with the rest of the world.

z. The recommendations are too broad, what are the priorities?

aa. The GEIS needs to give more emphasis to the economic benefits of Animal Agriculture.

bb. If we are going to upgrade environmental rules, we need to help farmers.

cc. Be careful when referring to “cheap food” when you mean “cheap farm commodity”.

dd. What are the “suspect” chemicals feedlots are putting in groundwater?

ee. Does document deal with chemical fertilizer as well as manure?

ff. Rural brain drain is hurting the farm economy.

gg. Farmers have to change to adapt to the changing world.

hh. Farmers are unfairly penalized for environmental problems.

ii. We need to make recommendations regarding trade policies.

Rochester

a. Pleased to see animal welfare piece, wants ban on subtherapeutic antibiotic use.

b. Concern over animals eating animals, need more emphasis on alternative systems.

c. Government bodies should work together to solve these problems, no new bureaucracy.

d. Trade associations can help solve many of these problems .

e. Stress the benefits of manure as an organic fertilizer.

f. GEIS document suffers from lack of prioritization of policies.

g. Air quality issues, language in recommendations is too soft.

h. You cannot enforce what you cannot measure.

i. Until we have science to accurately and economically measure whether complaints are valid or if health threats are real, the whole process will be nothing but unlimited confusion, frustration and litigation.

j. Urge legislature to put up the funds to measure and monitor the situation.

k. Social and community recommendations are the best throughout the GEIS.

l. Need to study the carrying capacity of Minnesota soils.

m. Language on role of government needs to identify priorities.

n. We need to rely on the judgment of our scientific experts in agriculture policy.

o. Board of Water and Soil Resources and SWCD's are doing a great job.

p. MPCA has some wonderful people who live and breathe this stuff.

q. Farmer's data privacy needs to be protected.

r. Economic recommendations are limited, this should be more positive.

s. Economics is the most important driver in agriculture.

t. Human health concerns are an important consideration of farmers.

u. Regulations need to be based on sound science and use cost-benefit analysis.

v. Risk assessment needs to be applied to any new regulation.

w. Livestock are ecologically important to southeast Minnesota .

x. Ten years is not enough time for all the feedlots to get into compliance.

y. Cost-share limits and amounts available are insufficient.

z. Encourage the use of "Green Payments" to good stewards.

aa. Most recommendations in the GEIS are designed to limit, regulate and confine animal agriculture. Our freedom to farm should not be jeopardized.

bb. Our right to privacy is not negated by our desire to farm.

cc. Animal welfare should be determined by experts not activists who rely on half-truths and isolated incidents.

dd. Nowhere does the report mention the money and jobs brought in by agriculture. These recommendations do not bode well for the future.

ee. PCA doesn't' know what their talking about.

ff. Urban encroachment is becoming a more serious problem in SE MN.

gg. Must be very careful with private data and personal privacy.

hh. Allow the 7020 Rules time to be implemented and time to work.

ii. MMPA supports voluntary certification and institution of BMP's.

jj. Further work is needed on design and siting of feedlots in karst areas.

kk. Recognize the immense economic and environmental benefits of manure.

ll. Permit flexibility in local land use regulation of feedlots.

mm. Manure management plans should be available for inspection by appropriate officials.

nn. Need to streamline the rules ands the permit process.

oo. All other states and Canadian Providences are friendlier to agriculture than Minnesota .

pp. GEIS documents are a wonderful resource for many people.

qq. Water quality in SE MN has been steadily improving in the last 10 years.

rr. The CAC needs to sit down and crunch the numbers to see what these policies cost.

ss. Leave codes of animal practice to veterinarians and experts.

tt. AMA has recommended a complete ban on the use of subtherapeutic antibiotics.

uu. Some GEIS recommendations go against the new feedlot rules.

vv. We need to do more for the family farms and young people to get into farming.

ww. Concern about negative externalities from animal agriculture.

xx. Medical doctor expressed deep concern about human health from subtherapeutic use of antibiotics in animal feed – it is a serious problem, especially for children.

yy. Is the water we are drinking here safe?

zz. Is the water quality in the state improving or worsening?

aaa. Can you prevent people from misinterpreting or misusing this information?

bbb. Can you explain this Phosphorus Index?

Mankato

a. What interesting things were found in analyzing the feedlot maps?

b. Value of this study is to guide future research and policy development.

c. Importance of exporting value-added products like meat, milk.

d. How do today's animal units compare with past history?

e. Laws are only as good as the enforcement.

f. What is impact of Right-to-Farm laws on feedlot nuisance claim?

g. The OFFSET odor model is an important and useful tool.

h. Concern about the loss of genetic diversity in animals.

i. Use animal numbers not animal units.

j. How are carcasses disposed of in this state?

k. How do you dispose of syringes and used antibiotic vials?

l. How are compost facilities designed to protect public health.

m. Producers need one-stop shopping for dealing with all the government agencies.

n. Minnesota should be aware that many other states are looking at our efforts.

o. Urban subdivision of rural land is a big problem near Mankato.

p. We should copy the Michigan law protecting farmers against frivolous nuisance lawsuits.

q. Old time low impact agriculture is becoming industrial yet it is still farming.

r. Industrializing agriculture and odor is creating problems like Valadco.

s. GEIS did not adequately look at alternatives.

t. Small farms are vanishing quickly, we must act quickly.

u. Most people in Minnesota want many small farms spread evenly across the land.

v. We are heading for Wal-mart agriculture and nobody wants it.

w. Many people have lost their joy for living because of these feedlots.

x. Big feedlots are destroying everyone's air and water. There is no free market.

y. Much of the feedlot controversy in Renville County is just old personal feuds that have been there for years.

z. You do not talk about wastewater ponds and industry's problems just agriculture.

aa. University's fertilizer recommendations for N&P are too low.

bb. There should be a formal cost-benefit analysis on the impact of every proposed recommendation.

cc. Livestock is the "cash cow" of agriculture. Economics section should be strengthened.

dd. Should some of these recommendations come from the federal level?

ee. Can contaminants from manure get into the tile drains?

ff. The health and safety of processing plant workers is an important issue.

gg. In Carver County, we have over 400 feedlots and all the major problems are caused by four or five operations. Facility Management is the most critical factor, not size.

hh. Talk about number of animals not animal units.

ii. Permits should be issued by watershed units, not counties or townships.

jj. Contract farming is a serious problem, destroying many small farmers.

kk. We need to preserve agricultural areas.

ll. Animal density limits are absurd. We need to control many other things first.

mm. Animal health and human health concerns, when does a county need an animal health officer?

nn. Human miscarriages related to hog feedlots according to Mankato Free Press.

oo. EAW's cost 30-50,000 dollars and all you need is 25 people to sign a petition

pp. I am concerned that staff is just working to promote the producer's agenda.

qq. I strongly support more funding and staff for MPCA – Rep. Ruth Johnson

rr. I do not think MPCA is a wealth of knowledge in all areas, U of M is doing work on BMP's and agriculture research.

ss. MPCA is writing documents when they should be doing enforcement.

tt. Anything over 50 animals should do an EAW and water testing .

uu. When something goes wrong who is responsible? Are these farms bonded?

vv. EAW's cannot be completed by most producers, they do not understand the questions.

ww. Social and environmental issues are critical to consider in this study.

xx. Quality of life in rural Minnesota has decreased due to large feedlots.

yy. You have to look at the issues of animal density limits and set numbers .

zz. We need to look at the costs of decommissioning old feedlots.

aaa. Odor from feedlots ands health problems from feedlot gases are a big concern to me.

bbb. Can Legislature require manure methane digesters at feedlots?

ccc. New technologies are being developed to assist animal agriculture.

ddd. Livestock in Minnesota consumes 2/3 of the corn and ½ of the soybeans.

eee. What is the impact of grazing on water quality?

St. Cloud

a. Air pollution problems at large dairies can be controlled with limekiln dust.

b. We must maintain favorable conditions for dairy farmers.

c. Schedule of meetings was bad for many dairy farmers.

d. If Minnesota's regulations are stricter than other states and countries, we will put our farmers at a competitive disadvantage.

e. We need to reduce conflict and promote environmental quality.

f. We need to allow the 7020 Rules time to work.

g. Support producer certification programs and BMP's.

h. Promote the beneficial aspects of animal manure use.

i. A cost-benefit analysis should be done on all CAC policy recommendations.

j. Public is not being informed of the chemical and bacterial problems.

k. Many people do what they have to do to make money.

l. CAC 100% consensus is a very difficult process. It watered down the policies.

m. Court decision on Timber GEIS limited use of this type of document.

n. Need more information on state-of-the-art technology developments.

o. What is going to be done to keep this document current and relevant?

p. Additional study and research is needed in several areas especially sustainable agriculture.

q. Subtherapeutic use of antibiotic must be quickly phased out.

r. Field validation of air models is essential.

s. It is important to quantify the hidden (Externalities) cost and benefits of animal agriculture.

t. We need to have MDA and the U of M provide more research and technical assistance to small and medium size farms using sustainable systems .

u. Animal welfare science must take precedence over animal production science.

v. Economics – this chapter is completely incomplete.

w. Missing is the cost of externalities and spillover costs.

x. I support recommendations 71, 72, 73, 74 and 76 and the conservation security act

y. We need greater collaboration between economist, sociologist, anthropology production framers, ecologist in studying impacts of different systems of animal agriculture.

z. Rural communities are losing young people, businesses and small farms.

aa. The push for bigger is better is tearing communities apart.

bb. We cannot wait until all the research is in before we start to take action.

cc. Citizen's at the grass-roots level need the opportunity to decide their own future.

dd. Small and midsize farmer need a market and a profitable price for their goods.

ee. Minority laborers in production and processing have special needs.

ff. Human health section does not consider the serious problem of random residential development.

gg. Strongly support the preservation of agriculture land from random residential development.

hh. There should be at beginning of chapter 13 a brief summary of federal and state programs (like chapter 7).

ii. Concerned about workers health at large scale confinement operations.

jj. Turkey growers of Minnesota commend the CAC for all their work on the committee.

kk. Small farms are not the problem, it 's these giant industrial operations.

ll. Really big operations do not care about their neighbors.

mm. Fertilizer salesperson preparing nutrient management plans is a conflict of interest.

nn. Why do counties and townships have to pay for road maintenance from industrial farms.

oo. Flies are horrendous near these large pig operations.

pp. If the ventilation system breaks down, within 30 minutes all the hogs at a confinement facility are dead, what does that tell you?

qq. There is no prioritization in the GEIS and we need to set priorities.

rr. Recommendations 15 and 22 dealing with odor should be given the highest priority.

ss. Because odor is subjective and there is little hard data, people are being told there is no problem, or just get used to it.

tt. Many people in rural Minnesota have become prisoners in their own homes due to tyrants at large confinement facilities.

uu. MPCA is understaffed they do not even know where these feedlot's are.

vv. We need to phase out antibiotic use in farm animals.

ww. We need to promote organic farming and free-range livestock.

xx. The problem in agriculture is the price we get for our commodities.

yy. Water TWP has erroneous information on the Minnesota River.

zz. Odor is a big problem and additional research is needed.

aaa. Recommendations must be based on sound science.

bbb. Recommendations must not prevent farmers from growing or expanding their business.

ccc. Why don't we require waste treatment facilities for feedlots like we do for human sewage, especially when these farms are near rivers and lakes.

ddd. Poultry industry cannot raise livestock without growth-promoting antibiotics.

eee. Spreading manure is a big problem for neighbors near the large operations.

fff. Some scientific research on antibiotic resistance is coming through the newspapers and popular press. This is becoming a serious problem.

ggg. It's too bad farmers can't get a fair price for milk, meat and grain.

St. Paul – University of Minnesota

a. State should encourage a system of sustainable agriculture .

b. We encourage increased funding for environmental enforcement and funding of research on critical issues.

c. We encourage the use of incentives and green payments to promote .

d. environmentally friendly alternatives promoting small and midsize farms.

e. We encourage open access to environmental data and public participation.

f. We strongly support humane treatment of animals.

g. Support sustainable alternatives to the industrial raising of livestock .

h. Support a complete immediate ban on subtherapeutic antibiotic use.

i. Small to midsize farms are the most efficient producers.

j. New legislation is needed to protect family farms from predatory practices of contract farming.

k. Pictures of grotesque animal cruelty was passed among the audience.

l. We should approve all 18 of Marlene Halverson's recommendations.

m. We must stop confinement creates for breeding sows.

n. In Minnesota, chickens and cows are often left outside to freeze to death.

o. Livestock cruelty crisis is not limited to Minnesota, it occurs all over the USA.

p. Hmong ethnic markets are nightmares of animal cruelty.

q. MDA knows all about these practices and is doing nothing to prevent animal cruelty.

r. All animals must receive a quick and pain-free death.

s. Confinement systems must be eliminated, animals have basic rights too.

t. Animals are individuals and cannot be treated as yield units.

u. CAC was totally biased against issues of animal welfare.

v. Every animal has a personality, a complex as any human being .

w. Plutarch said “But for the sake of some little mouthful of meat we deprive some soul of the sun and life and that portion of time they have been granted on earth”

x. Farm animals must be recognized as the sentient beings they are .

y. Every cow, every pig, every chicken that people chose to kill and eat are living, feeling, magnificent beings who deserve to at a minimum to experience the joy of nature.

z. I am a vegetarian by choice, the majority of people in this country eat meat. However, with that choice comes responsibility to know how they are killed.

aa. Adopt all 18 of Marlene Halverson’s recommendations.

bb. Strengthen and improve enforcement efforts against repeated noncompliance.

cc. We must determine external costs of livestock agriculture.

dd. Why didn’t the CAC approve all 18 of Marlene Halverson’s recommendations?

ee. All farm animals should be respected as sentient beings in their own right.

ff. Will subsequent CAC and EQB meetings be open to the public?

gg. Can members of the public make policy recommendations?

hh. What is the process from here on out?

ii. 8.8 billion animals are barbarically killed for human consumption every year. Animals should have a life before their death.

jj. I am a cancer survivor and am very concerned about the overuse of chemicals and antibiotics on farm animals. These chemicals are causing early puberty in our children.

kk. I am disappointed that GEIS relies on information from the U of M animal production scientist and not my sister, Marlene Halverson.

ll. If God didn't want us to eat animals, why did he make them out of meat?

mm. We disagree that human health should come before animal welfare.

nn. Is there any reference to burial of animals in the GEIS?

oo. How representative were the comments at tonight's public meeting?

pp. The CAC's requirement for unanimous consensus is puzzling. Why was this done?

Appendix C
Geographic Information System (GIS) Mapping of Feedlot Information

In 1999 the Environmental Quality Board (EQB) contracted with Minnesota Planning's Land Management Information Center (LMIC) to provide GIS support for the GEIS.

In the late 1970s a computer technology emerged that would later be called Geographic Information Systems (GIS). GIS is more than just a digital map making technology. It is an analytical tool box that combines the cognitive impact of a map with the power of data base technology, which stores information about the features appearing on that map.

Because each map feature is registered to real world coordinates, a user can "drill" through many different data layers and explore relationships among map features. This allows people to make more informed decisions by answering questions that may not be apparent without using advanced techniques of query, selection, analysis, and display.

Many of the questions regarding the impact of animal agriculture in Minnesota have a spatial component and, therefore, GIS will help answer them. However, before a question can be answered, the proper data must be assembled. The process by which LMIC collected feedlot information is discussed in this summary and in detail in the GIS Appendix to the GEIS.

LMIC was assigned the following tasks:

? Support the GEIS and Citizens Advisory Committee (CAC);

? Review existing feedlot data sources;

? Conduct pilot study for the collection of feedlot information for those counties with feedlot inventories not acceptable to the GEIS;

? Develop final statewide inventory database through use of county feedlot inventories and other relevant feedlot data sources;

? identify, collect and review other relevant data layers required for the GEIS spatial analysis to be conducted;

? Conduct spatial analysis of the GEIS feedlot inventory data, developing descriptive maps to answer questions arising through the GEIS process; and

? Recommend procedures and standards for continued maintenance and use of the inventories developed for this project, or potential future use of GIS.

A feedlot inventory/census database had to be constructed in order to perform the analysis needed by the GEIS. No such inventory existed, although some of the data required to build one could be derived from other sources. On advice oft he EQB and the GEIS Citizens Advisory Committee, it was decided that source inventories had to be more recent than 1996 and include feedlot location, species type and species count. The two primary sources of data chosen were existing county feedlots inventories and USDA Census of Agriculture data maintained by the National Agricultural Statistics Service.

LMIC contacted each of the State's counties to determine the extent and currentness of their feedlot inventories. Generally, county Department of Environment officials and Soil and Water Conservation District officials served as the main contacts. Table 2 of the GIS TWP summarizes the results of this comprehensive survey. Thirty nine counties turned out to have inventories that contained the information needed for the GEIS inventory project (generally inventories that met the "Level 2" or higher description as defined by the Board of Water and Soils Resources inventory handbook).

For those counties which did not meet EQB and CAC's feedlot inventory criteria identified in Section 2, an attempt was made to "fill in the gaps" with information from federal and state sources. The main source chosen was the U.S. Department of Agriculture's 1997 Census of Agriculture. The census of agriculture became a prime data source to fill these county gaps because it identified, except location, all of the information required by the GEIS. However, to use this database, farm operations had to be geo-located (while at the same time protecting the confidentiality of the responders). Locations were developed for LMIC by NASS employees through the use of data from county assessor's offices and three existing databases: MN Department of Agriculture-Board of Animal Health Swine database, MN Department of Agriculture-Food and Dairy Inspection database and the MN Pollution Control Agency's permit database. Going through each of these databases county by county, NASS matched name-address information and assigned the locational information to the census of agriculture information. The exact process and all its complications are described in the GIS TWP.

By combining the county inventories and the NASS datasets, LMIC obtained a statewide "inventory" or census estimating the location, size, and animal types for all feedlots in the state. Using this information, GIS techniques can be used to prepare maps combining feedlot information with information on many other characteristics which have also been geo-located across the state, for example, soil characteristics, topography, water bodies, and demographic data. These maps can then be used to investigate relationships and questions about feedlots. The GIS TWP contains a number of sample maps demonstrating this capability.

The assembled GEIS-GIS feedlot inventory database can serve as a valuable tool in the future for state and local officials, producers, and others. However, there are many ways in which the current data is limited. The GIS TWP contains an analysis of these issues and presents some recommendations on how the state could improve the database to be even more useful in the future.

How can GIS help the GEIS?

GIS has emerged as valuable tool to all types of management. Because the GEIS is gathering feedlot inventory and/or census information from a variety of sources, GIS provides the vehicle to analyze all on a compatible framework. GIS allows the user, which in this case is the GEIS and the people of Minnesota, to ask questions and receive reliable answers. Each database holds information developed by many individuals in different parts of the state or country. LMIC has gathered these information datasets and consolidated them into one statewide database accessible through GIS.

Many of the questions regarding the impact of animal agriculture in Minnesota have a spatial component and, therefore, GIS will help answer them. However, before a question can be answered, the proper data must be assembled. The process by which LMIC collected feedlot information is discussed in the next section.

Issues and Recommendations

Issue #1: County Feedlot Inventories

LMIC and the GEIS have established a working relationship with County Feedlot Officers, County Environmental Services and Soil Water Conservation Districts (SWCD). Fifty-four counties sent their feedlot inventories to LMIC to be used by the GEIS. This cooperation is what enabled the GEIS to develop its feedlot inventory database. The GEIS feedlot inventories are valuable information. By establishing a continued feedlot inventory update procedure, the counties and State of Minnesota would have the future ability to digitally map feedlot inventory information at a county, regional or statewide level.

Recommendation: Continue to add to and improve the county feedlot inventory database by doing the following:

- LMIC would continue to gather and update current county feedlot inventories. These updates would be added to the GEIS existing feedlot database.
- Gather county feedlot registration from those counties not having completed inventories, develop a digital file, send the digital file back to the county for their use in future planning and add the information to the current GEIS feedlot inventory database.

Issue #2: Quality and/or Standardization of County Feedlot Inventories

There is no "standard" for feedlot inventories. There are guidelines developed by MPCA and the Board of Soil and Water Resources. Additionally, many of the counties develop their inventories from a neighboring counties inventory. This method produces a variety of feedlot inventory databases in a variety of software. If a "standard approach" using a "standard software package" were developed, county feedlot inventories would be seamless and would provide for easy feedback.

Recommendation: Look into the possibility of funding either the MDA, MPCA, BWSR, LMIC or a combination thereof to develop a statewide inventory framework that counties could use. Use level three inventory counties as a starting point for this development.

Issue #3: MPCA Feedlot Registration Program

The 2001 feedlot regulation changes have a January, 2002 deadline. The MPCA will be receiving county inventories up to and beyond that deadline. The MPCA does not have a fulltime GIS staff person to work on the feedlot inventory database. Because LMIC is non-partial and has worked with all of the counties over the past three years as part of the GEIS, they should work with the MPCA to merge county feedlot information into a digital database that is;

? accessible;

? can be mapped by both the counties and the state;

? updateable by future or improved county feedlot inventories; and

? arranged for Data Privacy of farm operators.

The State would be doing an injustice to itself, as well as the counties, if this information were not developed into a comprehensive database that is accessible by the people of the State of Minnesota. The database would be compliant with all State Data Privacy laws and should be developed to ensure farm operator privacy.

Recommendation: Have the Strategic Office of Long Range Planning, Land Management Information Center work with the Minnesota Pollution Control Agency and the Department of Agriculture to develop a statewide feedlot inventory database that is usable at both the county and state level.

Issue #4: Perceptions of MPCA and/or the State

There is a perception in agriculture that the State and/or the MPCA should stay away and not be a “Big Brother”. The reality is that feedlot waste has impacts to the environment, public health, social well being and the economy. Most operators are hard working members of the community. It is generally just a few that make the headlines.

By working with the MPCA, MDA and the individual counties, a statewide feedlot inventory would allow the counties to prioritize those farm operations that are at medium or high risk. Funding is available through the Board of Soil and Water Resources and the MPCA Delegate program to help those operations clean up their act and continue to provide a product to the community. Identifying feedlot location, when used properly, is beneficial to the economy and not an intrusion on the farm

Recommendation: Fund and support involvement by MDA, PCA, Minnesota Counties and LMIC to identify ways to develop and merge databases such that the Counties and the people of the State of Minnesota will benefit.

Issue #5: Status of Available Digital Information

Many counties are using statewide datasets for feedlot inventory analysis. Unfortunately, many of these datasets are ten or more years old. A few of the main databases include:

- ? Digital soil mapping;
- ? Digital Orthophoto quads (DOQ; 1990-1991);
- ? 30-meter Digital Elevation Models (DEM; 1990-1991) for elevation and contours;
- ? USGS topographic maps (DRGs);
- ? Land Use and Cover (1989);
- ? A number of statewide hydrologic data sets (Mn/Dot, DNR);
- ? Ownership – in a state that is almost ¼ public land, no agency coordinates comprehensive ownership records;
- ? Aerial photos (1991 and again in 1996-1998)

Recommendation: A web-based data needs survey completed in January, 2001 (October to December, 2000) indicated that, to many users, many of these key data sets are now dated, bordering on obsolete. This points out the tremendous need for the state to continuously fund updating of these basic resource inventories.

Recommendation: It is our recommendation that a coordinated effort be made be made between state and county agencies to collect feedlot information in a uniform manner and with adequate positional data so that it can be used to address concerns at a local level. Furthermore, this information should be converted to a digital format, housed in a single repository.

Appendix D

CAC Policy Recommendations

The 1998 legislation establishing the GEIS directed the EQB to establish a committee representing the livestock industry, environmental interests and other stakeholder groups to provide advice on the scope and content of the project. After soliciting and receiving over 250 public nominations, the EQB chair appointed a 25-member Citizens Advisory Committee (CAC) to assist with the GEIS. Committee members were selected from diverse interests to achieve a balance of viewpoints but members were not considered to represent their organizations. Each member was asked to nominate one or two alternates, subject to approval by the EQB chair; the alternate could participate on behalf of the member if the member was unable to attend. Both the member and alternate attended many of the CAC meetings. In these cases, only the member was permitted to vote; the alternate could observe and participate in discussion. Because of the length of the process, several members were replaced, often by a former alternate. During the early stages of the process the CAC had 25 members, but two members resigned in mid-1999 without a direct replacement. A representative of the Minnesota Health Department was added and the CAC operated with 24 members for the remainder of the process.

The CAC was at the heart of the GEIS process. The CAC developed the recommendations approved by the EQB for the scope and content of the GEIS, as well as the policy recommendations contained in the Draft and Final GEIS Summary documents. The CAC met monthly from July 1998 through November 2001, usually for two days each month. Occasionally, a meeting was skipped, but in other months extra meetings or a three-day meeting were needed. Each meeting was run by a trained and neutral facilitator from the Minnesota Department of Administration, Management Analysis Division, contracted by the EQB to assist with the CAC. The CAC adopted ground rules for its meetings and decision-making. The CAC reached agreement on most important matters, usually by consensus: “100% willing to support it, 70% comfortable with it,” as the ground rules expressed it.

The CAC was responsible for making key recommendations to the EQB on the following:

- Draft and final GEIS scope (based on public comments) including the topics to address and the specific questions to attempt to answer.
- Selection of consultants to prepare the literature review on the identified scope topics.
- Tasks to fill in information gaps identified through the literature review and the money to be spent on each.

- Selection of consultants to perform the tasks.
- Revisions needed in the draft literature review reports and draft technical work papers.
- Policy recommendations to be included in the GEIS.
- Revisions to the initial draft GEIS topical chapters.
- Final GEIS document based on public comments on the draft GEIS.

In addition to making these recommendations, the CAC spent several hundred hours in meetings and in personal time between meetings reviewing, commenting and reading documents and background information on animal agriculture. Copies of all technical reports were provided to the CAC in advance of their meetings. During the literature review phase of study, the CAC received presentations from each topical team at the draft and final report stage. Likewise, during the technical work paper preparation stage, they heard reports from the consultant teams at the draft and final stages.

In addition, the CAC attended public comment meetings and toured a variety of livestock operations. Experts on a number of topics were brought in to brief the members on key issues. Over three years, EQB staff estimate that each CAC member contributed at least a thousand hours, much more in some cases. When multiplied by the number of CAC members and their alternates, it is clear that many thousands of hours were donated to this project.

The following people served on the CAC, or participated in at least one meeting, as members or alternates (Note: where two or more names are given, the original member was replaced during the process):

Ken Albrecht, retired farmer and local official, North Mankato

Gary Allen, Gar-Lin Dairy Farms, Inc., Eyota
Alternates: Len Bengtson, Ron Durst

Patricia Bloomgren, Minnesota Department of Health (added to CAC in 1999)

Brian Buhr, University of Minnesota, Department of Applied Economics (resigned)

Paul Christ and Myron Just, Minnesota Agri-Growth Council
Alternates: Myron Just, Paul Christ, Tom Cochrane

Robert Ferguson, Commissioner, Jackson County
Alternate: Jim Ische, Commissioner, Carver County

Amy Fredregill and Larry Schultz, Izaak Walton League
Alternates: Cheryl Kohls, Rachel Hopper

Troy Gilchrist, Minnesota Association of Townships
Alternates: John Dooley, Kent Sulem

Roger Gilland and Dennis Bottem, Minnesota Cattlemen's Association
Alternate: Greg Gosen

Fraser Hart, University of Minnesota, Department of Geography

Ed Heglund, Minnesota Soybean Growers Association
Alternates: Dave Roben, Roger Dale

Patricia Henderson, University of Minnesota, College of Agricultural, Food and Environmental Sciences

John Holck, Gretchen Sabel, and Jim Sullivan, Minnesota Pollution Control Agency
Alternates: Gary Pulford, Jim Sullivan, Chris Lucke, Myrna Halbach, Don Jakes

Galen Lisell, farmer, Roseau
Alternate: Connie Lee

Suzanne McIntosh, Clean Water Action Alliance (resigned)

Helen Palmer, Minnesota League of Women Voters
Alternate: Andy Otness

Donna Peterson and Tom Dunnwald, Minnesota Lakes Association
Alternates: Tom Dunnwald, Patricia Wolf

Dave Preisler, Minnesota Pork Producer's Association
Alternate: Jim Quackenbush

George Raab, The Turkey Store Co.
Alternate: Gregg Gleichert

Chris Radatz, Minnesota Farm Bureau
Alternate: Duane Albers

Tina Rosenstein, Nicollet County Environmental Services Director

Mark Schultz, Land Stewardship Project
Alternates: Lynn Hayes, Dave Serfling, Mara Krinke

Kristin Sigford, Minnesota Center for Environmental Advocacy
Alternates: Sam Sunderlin, Calvin Alexander

Harold Stanislawski, Minnesota Department of Agriculture
Alternates: Teresa Seidel, Paul Burns, Matt Drewitz

Andy Steensma, Minnesota Farmers Union
Alternates: Peter Takash, Jim Tunheim

Tim Tracy, AgStar Financial Services, Mankato
Alternates: Jeanne Scharf, Dave Hoelmer, Don Farm

POLICY RECOMMENDATIONS

In addition to collecting and analyzing detailed technical information, throughout the course of the GEIS process CAC identified policy recommendations for the Minnesota Legislature and the EQB, and tried to assign priorities to the recommendations. The CAC felt that each of the policy recommendations was extremely important. As a group they were reluctant to prioritize the recommendations or split these apart into the technical chapters. The EQB member agencies preferred developing policy priorities and separating the policies into appropriate subject areas with supporting information for each policy wherever possible. In order to address both preferences the material is presented in both fashions. The entire set of 77 policy recommendations is contained in this appendix for reference. The individual policy recommendations with supporting narrative are also presented in the policy and priorities section of the Final GEIS Summary document. These recommendations were developed by the CAC using their knowledge of animal agriculture issues and expertise gleaned through the three-year GEIS process. Additional specific technical recommendations proposed by the various expert consultants can also be found in the sections of the Literature Summary and in Technical workpapers.

In developing these policy recommendations, the CAC decided to require unanimous consensus on any policy recommendation passed. This was designed to prevent any majority or minority faction of the CAC from being able to control future policy direction. A large number of policy recommendations were discussed by the CAC but those that could not be unanimously agreed upon do not appear in this appendix. The recommendations that were discussed, but not agreed to can be found in Appendix G. The recommendations contained in this section are subject to the approval of and potential revision by the Environmental Quality Board.

The CAC met on November 13, 2001 to review their original 76 recommendations in light of the public comments received on the Public Review Draft GEIS. In preparation for the meeting, each CAC member received copies of all written comments, summaries of comments given orally at the public meetings, and two compilations of comments relating specifically to policy recommendations, one from the oral comments and one from the written comments. These compilations of comments related to policy recommendations were prepared specifically to aid each CAC member in deciding if he or she wished to advocate changes or additions to the 76 original policy recommendations. At the November 13 meeting, the CAC as a group determined NOT to make any changes to the original 76 recommendations, but did add a 77th recommendation regarding the extension of the existing moratorium on open-air swine manure storage basins.

Themes of the GEIS process: Goals and Values

While each of the 77 policy recommendations deals specifically with a particular issue, there are several themes that run across issue areas and that can be used as a summary of the recommendations. These are:

∃ ***Support Communities:*** Encourage community involvement and improve dialogue concerning animal agriculture issues in order to prevent or resolve conflict and identify mutually acceptable alternatives; be responsive to community values, and support local control over land use decisions.

∃ ***Improve Permit Process:*** Create a feedlot permit process that identifies and resolves environmental problems, allows meaningful dialogue among affected individuals, is efficient and predictable for all concerned parties, and includes recourse and enforcement.

∃ ***Enforce Existing Laws and Rules:*** Laws are only effective if they are vigorously enforced and persistent violators are penalized in a meaningful fashion.

∃ ***Improve Data Access:*** Develop better data gathering and management, such as the feedlot inventory, permit files, and complaint logs, while clearing up conflicts over data availability and privacy.

∃ ***Identify Costs and Benefits:*** Develop a method for estimating the social, environmental, economic costs and benefits of various systems of animal agriculture to the community.

∃ ***Protect Resources:*** Work to protect water and air quality and human health for the future by addressing related issues while at the same time ensuring the well-being of farm animals.

∃ ***Provide Financial Assistance:*** Provide funding and financial assistance for producers, research and development, and implementation of various GEIS recommendations.

Human Health Policy Recommendations

2. Make a greater effort to inform the public about the public health implications associated with disease occurrence, disease transmission, and antibiotic resistance from animal agriculture. Information about steps being taken to protect public health by farmers, processors, industry groups, government, as well as research by academic institutions, industry organizations and government, should be better publicized.

3. Support a comprehensive national program to promote the judicious use of antibiotics for both human health and animal health. The priority use of new classes of antibiotics should be limited to human use. The sub-therapeutic use of antibiotics as a growth promoter in animal agriculture should be reviewed and phase-out considered where science has provided adequate supporting research.

4. We recommend that the federal government publicize and enforce the existing ban on the use of ruminant carcasses and offal in animal feeds to minimize the Bovine Spongiform Encephalopathy (BSE) transmission threat in the US.

5. We support research to characterize health effects, quantify source strength, and determine the environmental fate of outputs of animal agriculture that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research.

6. National systems need to be developed and implemented to track antibiotic resistance in animal agriculture outputs and to track other diseases that can be passed between animal and humans, including surveillance of such diseases in farm and food industry workers.

7. Accelerate the Minnesota Dept of Health efforts to set health-based standards for chemicals.

8. Human health concerns exist without regard to the size of a feedlot operation or species of animal being raised. Therefore, all feedlots and food animal operations need to comply with the regulatory programs that protect human health. State Financial resources will be necessary both for the permitting/enforcement agencies and for the implementation of appropriate safeguards by farmers.

9. If a complaint investigation validates the probable exceedance of health standards by emissions or discharges to the environment, the operator must show compliance through continuous monitoring or mitigation.

10. Encourage worker safety plans for feedlots.

11. Nitrate is the most common contaminant in Minnesota's ground water. Best management practices should be required for land applications of manure and commercial fertilizer to protect all drinking water supplies.

12. Encourage development and implementation of ISO-9000 type approaches in food safety and quality assurance, which provide product traceability, higher value and higher quality in food products. This will allow producers and feed providers to identify the source of animals and animal feed in the event of an outbreak of disease.

Air Quality and Odor Policy Recommendations

13. Encourage the utilization, continuous improvement and field validation of all applicable air emission and air dispersion models as accepted by EPA and/or PCA to develop tools to deal with air pollution control.

14. Encourage the utilization, continuous improvement and field validation of applicable computer programs and models, such as OFFSET, which can aid in predicting appropriate operational practices, setback distances and odor levels.

15. Reform the odor complaint process to respond more expediently and require documented notification to the facility owner that a complaint has been received. Develop a central and accessible database to log complaints, responses, findings and resolution data, using objective testing tool with standardized protocols.

Ex. 1: Conduct a detailed inventory of feedlot air quality monitoring and odor complaint data, focusing primarily on the most heavily agricultural counties.

16. Facilitate and encourage independent standardized third party evaluations of feedlots that have confirmed odor events to customize site solutions to remedy the underlying problems.

17. An independent third party should be contracted to assess and characterize existing data that would lead to the development of a statewide emission inventory for air pollutants to facilitate continued surveillance and air modeling of sources.

18. Encourage and support the research and development and technology transfer of livestock air quality control technology.

    Ex. 1: Develop alternatives for more effectively dealing with the persistent problems of agitation pumpout odor air quality problems

    Ex. 2: Expand the MPCA ambient air quality monitoring network to characterize more fully agricultural impacts from feedlot operations.

    Ex. 3: Require feedlots siting new operations or expanding existing facilities to use the OFFSET model or similar odor setback evaluation tool to aid in designing the facility to minimize off-site odor impacts on potential receptors from manure storage units.

19. Conduct a one-time independent third-party audit of the PCA hydrogen sulfide program and evaluate and implement findings as appropriate.

20. EQB should annually monitor and report on effectiveness and applicability to Minnesota of other states' and countries feedlot air and odor regulatory and other activities and make appropriate recommendations.

21. Support increased federal funding for air quality and odor research and incentives for improvement related to feedlots.

22. Maintain state ambient air quality standards for H_2S emissions and improve enforcement against long-term non-compliant facilities.

23. Require air quality evaluation and/or mitigation (surface area and odor analysis) on new construction or expansion of outside open liquid manure storage.

Water Quality, Soils and Manure Policy Recommendations

24. Encourage the formation of a program similar to the Michigan Agriculture Environmental Assurance Program (MAEAP). This would be a comprehensive proactive, and voluntary agricultural pollution prevention program, which ensures that participating producers use effective land stewardship practices that comply with local, state and federal regulations. Certification of feedlots would be included.

25. Make the cost incurred to comply with the Phosphorus Index and improved nitrogen management for land application eligible for cost share funding under programs administered by BWSR, MDA, USDA and MPCA.

26. Develop and require the use of the Minnesota Phosphorus Index to determine appropriate manure and chemical fertilizer (nutrients) application rates based on the P needs of a particular crop on a particular soil type.

27. The Legislature should fund and require completion of a Level 3 inventory of feedlots for each Minnesota County. The inventory should include a Feedlot Evaluation Model (FLEVAL) analysis for all open lots, and identify potential CAFO's (confined animal feeding operations, as defined by the U.S.EPA).

28. Require all facilities with greater than 100 animal units at any time during the year, to prepare complete manure management plans, including an estimate of the quantity of manure generated annually and farm land potentially available for manure application at agronomic rates for the crops and soils present. These plans should be kept on site and available for inspection upon request of authorized regulatory officials.

29. The EQB should monitor and report bi-annually on the effectiveness of the states' and countries' feedlot water quality activities and applicability of these practices to Minnesota's situation. The EQB shall periodically update the GEIS document and make appropriate recommendations to Minnesota state agencies and the Legislature to revise and improve our state programs based on these findings on emerging issues in animal agriculture.

30. Strengthen and improve enforcement efforts against long-term non-compliant facilities. Identify and vigorously pursue legal actions against feedlot owners and/or operators who have been consistent "bad actors" with a pattern of repeated violations of environmental or public health standards.

31. Accelerate the Minnesota Department of Health efforts to set health-based standards for suspect chemicals of concern in surface and groundwater in consultation with appropriate federal agencies.

32. Require smaller size operations (between 50 and 300 animal units) to prepare and follow a manure management plan.

33. Best Management Practices (BMPs) should be implemented for all land applications of manure and commercial fertilizer (nutrients) to protect drinking water supplies.

34. Coordinate the collection of surface and groundwater monitoring data from the appropriate state, local and federal agencies and non-governmental organizations, the continuous improvement in data quality and quantity, and field validation and interpretation of data using models as accepted by EPA and/or PCA for water pollution control. Maintain this information in an electronic database with summary information available to researchers and the general public.

35. Encourage and support the research, development, and technology transfer of improved feedlot operations and livestock manure quality control techniques through the University of Minnesota and the Extension Service.

36. Support increased federal funding for research to improve water quality and to provide flexible incentives for operational and environmental improvement related to feedlots.

37. BWSR should review the FLEVAL feedlot water pollution potential model for accuracy, address inaccuracies, and add a section designed to assess potential runoff impacts from land application of manure and chemical fertilizers.

38. Research nutrient and pathogen losses to surface tile inlets in manured and chemically fertilized fields under a variety of conditions (e.g., wet weather events, seasonal timing of application, method of application) at times when inlets are likely to be active (snow melt, following rain events). Review research results and make recommendations for nutrient handling including adjusting rules and accelerate adoption of best management practices using results from the research.

39. BWSR should revise the content of its guidebook for Level 3 inventories to address storage and land application of manure.

40. County and state feedlot inspection programs should include monitoring for compliance with nutrient management plans and with other land application requirements.

41. The Legislature should fully fund cost-share needs at the historic contribution ratio, or
$ 8.1 million per year, less federal contributions, and lobby for federal Environmental Quality Incentive Program contributions. If this does not occur 1) a strict ability-to-pay eligibility criterion should be imposed; 2) the grant ratio should be reduced and the Ag Loan programs increased; and 3) only those practices with the highest benefit-to-cost ratio should be eligible for cost-share.

42. Develop a strategy and prioritize mitigation activities to move towards compliance with total maximum daily loads in impaired watersheds.

43. Because the current permit process monitors adequate individual acreage for manure application but no one is currently monitoring the regional aggregate of acreage available for manure application, we encourage exploration of animal density limits or a mechanism to monitor regional acreage claimed for applications on a watershed basis.

44. Support paired watershed studies that evaluate the impact of existing management practices and best management practices on water quality. Review results to make recommendations for nutrient handling including adjusting rules and accelerate adoption of BMP's using results from the paired watershed studies. Range of scales studied could be from 20 acres to 10,000 acres that would allow analysis on different levels.

Land Use Policy Recommendations

45. Improve the quality and quantification of complaint information on feedlot operations. There must be consistent reporting formats, as well as comprehensive collection of all complaints. Complaint investigations conducted by counties and the state should be compiled into one electronic database. Additional complaint information should be documented, and include such data as the responding agency, nature and location of complaint site, and complainant and resolution of complaint.

The facility against which the complaint is lodged should be notified immediately, subject to all the restrictions of the Data Privacy Act.

46. Evaluate the effectiveness of conflict resolution applications and disseminate findings.

47. Promote public education on the responsibilities and limitations of each level of government (local, state, and federal) in regulating feedlots and handling complaints. Inform citizens of lawful methods of redress available in dealing with conflict over feedlot operations and management.

48. Explore and evaluate conflict management tools to address conflict situations. Make these tools available for use by and at the direction of local units of government.

49. Encourage the exploration and evaluation of innovative planning policies and land use techniques such as;

   a. Agricultural Tiered Zoning classes
   b. Agriculture Preservation Districts
   c. Setbacks based on the OFFSET setback distance estimation model developed by the University of Minnesota, or equivalent tools for facility planning and design
   d. Notification of potential new residents of possible nuisance conditions from normal agricultural operations
   e. Purchase and/or transfer of development rights
   f. Buffer zones around environmentally sensitive features
   g. Promoting livestock friendly zones
   h. Relocation of feedlots away from designated environmentally sensitive regions
   i. A process for local road authorities to grant odor easements on public roads adjacent to feedlot operations.

50. Recognizing the importance of local land use involvement in feedlot siting and conditional use provisions, explore ways of enhancing coordination of local government planning and zoning efforts relating to animal agriculture to reduce conflict and avoid duplication of efforts.

Role of Government policy recommendations

51. Identify two or three clear priorities on which to focus Minnesota feedlot programs over the next few years. Once these priorities have been identified by an open public participation process, such as the GEIS, direct the limited resources available to targeting these items primarily for a period of at least five years.

52. Explore and evaluate the concept of an "Integrated Outcome Management System" to address the priority issues. Select the appropriate mix of compliance tools to fit the nature of the particular problem.

53. Compile existing validated data and conduct research that provides for more consistent environmental baseline and outcome data to assess progress against identified priorities. Information that is available should be integrated with the new feedlot registration program and made accessible to the public, state and local officials.

54. Create an emerging issues research agenda. The results of relevant research would be reported as annual updates to the Animal Agriculture GEIS.

55. Improve the collection, maintenance and analysis of facility operational and environmental monitoring data for feedlot facilities.

56. Recommend that the MPCA and delegated counties keep complete permit files, including summary statistics. Information considered public should be available without violating public data and/or privacy statutes. Make recommendation to integrate information between levels of government. Further, need to address the proprietary, private and public data issues.

57. The state should provide more training for feedlot officers and local government staff on the environmental review process.

58. The MPCA and its delegated county partners should conduct periodic inspections of feedlots. Given the large number of facilities, the inspection program should be targeted to the riskiest operations and the most sensitive locations first.

59. The Legislature should provide guidance and resources to develop a coordinated watershed-based approach that includes and encourages local water plans, to address non-point source pollution issues.

Social and Community Policy Recommendations

60. Explore with producers, community leaders and other stakeholders ways to produce livestock that 1) demonstrates the connection between livestock and community viability, 2) respects neighbors and the community's quality of life, and 3) protects the environment.

61. Initiate discussion groups, policy seminars, and conferences for producers, community leaders, policy makers, and other state and local stakeholders, where the many issues of livestock expansion can be discussed and mutually acceptable alternative options developed.

62. Improve responsiveness, local presence, and coordination among state agencies at the most local level through state initiatives and increased funding for staff activities.

63. Increase funding and information on programs that assist small and mid-size producers to fulfill environmental stewardship responsibilities.

64. Working with producers, establish and promote marketing alternatives for small-sized producers and those not engaged in contract production.

65. Initiate a comprehensive examination of livestock processing industries in Minnesota, identifying the connections between production, processing and social and community impacts.

Animal Welfare Policy Recommendations Section

66. Establish humane codes of practice for Minnesota animal agriculture that reflect scientific knowledge and public concerns regarding the health and well-being of agricultural animals.

67. Research animal production methods that foster animal welfare. It should be the goal to promote systems that are both supportive of animal welfare and are economically feasible. The basic animal welfare practices should be disseminated widely among educational institutions in the state.

68. Develop voluntary certification programs that include basic animal welfare standards. Encourage and facilitate marketing of the products of such programs.

69. The state should consider farmer and farm worker certification programs to ensure that the people responsible for animal care understand the basic principles of animal biology and behavior.

Economics Policy Recommendations

70. Develop an efficient, environmentally sound, effective, feedlot permitting process that enhances and attracts livestock production.

71. To support animal agriculture in Minnesota consider the following options:

    a. Retain and help facilitate modernization and expansion of existing processing plants

    b. Foster opportunities for producers of livestock products to capture value added from further processing and marketing.

    c. Offer financial incentives to attract new processing plants competitive with other states.

72. Fund research to develop and report the external costs and benefits of Minnesota's animal agriculture production and processing.

73. Encourage the development of alternative agricultural production systems in Minnesota, such as supporting beginning farmers, assisting transitioning farmers, and coordinating production and marketing systems for producers.

74. Encourage and support the use of "green payments" (payments to farmers linked to use of environmentally beneficial practices) in addition to the present U.S. farm policies, and investigate ways to incorporate this kind of program in state programs.

75. Encourage continued antitrust vigilance at the federal and state levels.

76. Develop an efficient, environmentally sound, community and producer-friendly, permitting process that supports, enhances, and attracts processing facilities.

77. Develop a method for estimating the economic impact of an existing or proposed livestock enterprise, giving best estimates of the value of positive and negative externalities.

78. The CAC recommends a continued moratorium on the construction of new open-air swine basins, except existing facilities may use basins of less than 1 million gallons capacity as part of a permitted waste treatment program for resolving a pollution problem or to allow conversion to a different animal type, provided all standards are met.

Updating the GEIS

As the GEIS has progressed, it has become apparent that some sort of periodic GEIS update, research advisory and policy implementation component needs to be a major recommendation of the Final GEIS. Feedlot issues will continue to be controversial and time-consuming. The current GEIS project should be regarded and publicized as a major accomplishment, although additional ongoing work is needed in several key areas.

No matter how high the quality of information contained in the document or how wise the suggested policy recommendations, the real proof of this project will be in how these ideas are implemented. It will be up to the Minnesota Legislature to evaluate the proposed policy recommendations and decide what changes need to be made in Minnesota laws and rules.

One important component of the Forestry GEIS was the establishment of an implementation group, the Forest Resources Council, to ensure that the recommendations of the GEIS were carried forward and, to the maximum extent possible, put into practice.

CAC recommends that an EQB staff liaison position be established to carry on the work begun by the GEIS.

In many areas, new research will have to be integrated into the existing document. The CAC recommended that the GEIS document be updated every two years. The GEIS provides an excellent foundation from which to work, but follow-up on the document and the policy recommendations is necessary to maximize the future value of this project for the citizens of Minnesota. It would be logical to set aside resources so that a full-time staff member of Minnesota Planning can carry out the GEIS updating, legislative contacts and state and federal agency liaison tasks.

The GEIS was a process and a project. As the document evolved and information became available, it became apparent that certain of the original goals were not feasible. At the beginning of the process, the Legislature and the CAC had extremely high expectations in many areas. As the GEIS progressed there had to be modifications to the original scope of work. Some of the original goals were discovered to be impossible to accomplish with the time, money and information available. The GEIS originally was intended to do a much more thorough job of analyzing alternative or sustainable systems of animal agriculture, cumulative impacts of feedlot facilities, economic aspects of different production systems, with particular emphasis on externalities, and the air quality and odor dilemma. In each of these areas, the Final GEIS fell short of the goals set forth in the Scoping Document. Clearly, the original goals were extremely ambitious and money available to collect information and conduct analysis was limited.
Due to the complex and dynamic nature of the feedlot problem, the GEIS, although technically adequate and complete, will not be regarded as sufficient in several controversial areas by a number of citizens and special interest groups. The EQB has followed the direction of the Legislature, addressed the scoping questions raised by the public and the CAC, and identified policy recommendations to the maximum extent practicable and economically feasible. There are certainly areas of the document that could be improved if supplemental resources were available. Additional research and state agency program modifications will be needed in the future to deal with emerging issues and trends.

Keeping the GEIS recommendations up-to-date would also require the formation of some type of continuing advisory group. If updated recommendations are to be developed it should again be by majority agreement of stakeholders. It may not be necessary to require unanimous consensus on future policy recommendations.

The CAC discussed future updating of the GEIS, but did not come to agreement on a specific recommendation for a mechanism to provide ongoing advice. However, it did identify several elements that should be included in whatever updating process is ultimately chosen. Namely, updating the GEIS should:

1. Be the responsibility of the EQB

2. Have an ongoing public input opportunity component;

3. Not involve an advisory group as large as the original CAC;

4. Have a staff member at the EQB to assist with feedlot environmental review and act as a liaison between state agencies, environmental and producer groups, and prepare reports as needed; and

5. Periodically update the existing document and report to the EQB and Minnesota Legislature on emerging issues and the impact of these on Minnesota animal agriculture.

6. Work with the Minnesota Legislature to enact laws and rules evolving from the policy recommendations made by the CAC and the EQB.

Appendix E

Copies of written public comments received on GEIS

The comments in this appendix were sent in written forms, as typed letters, written in long hand, sent as post cards or as electronic mail. The items were scanned by Omnipage software and converted to a consistent Word document file. In cases where handwritten comments were provided, EQB staff did their best to translate the penmanship.
No attempt has been made to censor the contents of any of the comments. These are provided, as received, for your information and review. EQB staff does not attempt to answer all the issues or concerns expressed in these submitted comments within this appendix. Many of the same issues are dealt with by EQB staff responses provided in Appendix B1of this Final GEIS. When commenters use policy recommendation numbers, they are referring to the CAC policy recommendation numbers used in Appendix D of this document. Comments received from any citizen,
CAC members, State Agency staff and management, EQB Board members are all included in this appendix.

Paul R. Carr
34278 60" St.
Blue Earth, MN 56013

Minnesota Planning Animal Agriculture GEIS
658 Cedar St. Room 300 St. Paul, MN 55155

To Whom It May Concern:

As you draft The Generic Environmental Impact Statement on Animal Agriculture, I would like to make a few points in which I hope you consider. They involve both environmental and economic issues regarding livestock production.

Many rural communities are concerned with declining populations. Opportunities for employment for younger people are limited in these rural communities. Crop production alone is not enough in many cases to keep younger potential farmers around or even to keep established ones profitable. Those producers with livestock, though, many times, although certainly not always, will have more room for a son or another person to join the operation. It's clear that livestock and crop production together allow for more employment and income on the same limited land base than does crop farming alone. A producer in my county recently made the comment that he had heard at a presentation on the economic influence of a local livestock industry. The statement was made that 40 million bushels of corn put through an ethanol plant employs roughly 100 people. Forty million bushels of corn put through hog production and processing employs roughly 5000 people. While certainly this is no attempt to knock ethanol, it should show the importance of a local livestock industry.

True facts must be taken into account when making changes to state feedlot rules or crop nutrient guidelines. An expanding feedlot can be a very hot topic as you well know. Many people not farming, after hearing of an expansion, begin protesting over potential smell and other environmental problems. How much of this protest is purely emotional? Living in the country always has involved the smell of livestock, although not as much as today in some cases. Farmers in some situations in the past have located feedlots on poor sites causing problems, but why should livestock production be limited if manure applications, site placement and design are made following rules that restrict pollution to levels of other areas of production agriculture. Human emotions should not override facts on pollution. Thank you for your consideration.

Sincerely,
Paul R. Carr

Gentlemen,

I would like to comment on the GEIS proposal, the number of animal units for small should be higher than 100 maybe like 500, if we have to modify small units less than 500 will just go out of business as 100 animal units is not enough to generate enough cash flow to survive.

If there are modifications that need to be made you had better send a way for us small producers to pay the bill as there is nothing in much of any farming on the small scale, it just will drive us to take city jobs away from people in town.

Minnesota passed a feedlot law just a few years ago now you want to drive out the last of the small operators.

Yours Truly,
Harley or Jo Vogel
21538 KC RD
New Ulm, MN 56073

9-10-01
Comments Regarding Feedlot GEIS

We own and operate a 125-cow dairy farm near Albany in Stearns County. Our farm consists of 820 (owned and rented) acres- 550 are tillable (alfalfa, corm oats and soybeans); the balance is pasture, .woodland and wetland. Many homes surround our farm. Pelican Lake, with over 100 homes, is just north of our dairy facility. These people are our neighbors and some are our landlords; they enjoy living in the country or by the lake and so do we.

We operate our farm as a business, yet as farmers we have a deep and profound respect for the environment we live in. The soil, for which we are only caretakers, provides our farm its existence. We monitor our soils nutrient levels, apply livestock manure accordingly, follow a rotation of crops and employ tillage and conservation practices that enhance soil productivity. It is our goal to leave the soil in better condition for the next generation.

Our dairy herd enables us to be better caretakers of the soil. Experience indicates manure carefully stored and applied is a much better source of crop nutrients than commercial fertilizers. Rotation of row crops, cereal grain crops and grass and alfalfa greatly reduce or eliminate our need for pesticides and herbicides. As crop yields increase because of these practices more crop residue is incorporated into the soil improving soil tilth and reducing runoff and erosion. On our farm livestock and cropping compliment each other.

I would not consider offering food produced on our farm for consumption if it were not safe. We consume milk and meat from our dairy herd and eat produce from our garden and orchard. A vaccination program designed by our veterinarian is strictly followed and antibiotics are used judiciously when prescribed by our vet. In addition all animals given antibiotics are tested to insure the antibiotic has been flushed from their system.

Manure stinks. We make every effort to minimize the odor. Pumping and applying early spring and late fall greatly reduce odor as well as being a better time for the crop and soil. Manure is incorporated as quickly as possible to reduce odor and minimize nutrient loss.

Manure from our dairy herd is a valuable by-product and is not a waste product. The dairy, young stock and calf barns are well bedded and ventilated. An animal in a clean comfortable environment is a more healthy, productive animal and a neat clean facility greatly reduces barn or livestock odors.

I carefully reviewed all 76 points of the CAC Consensus Recommendations. I can envision countless reports, substantial costs and considerable time for our operation. This is time, effort and funds taken away from the care of our dairy herd and soil. I would suggest rather than more rules and regulations, education and information may be more beneficial. Many of the 76 points have social as well as economic considerations for our farm. As stated previously, my family and I live work and play here. Lets not create a

system that places my dairy farm at an economic disadvantage to dairy farms in other states
Thank you for your consideration.

Sincerely,

Jim Gondringer

Chairman - Steams County Dairy Advisory Board

The Courier

Bishop Harrington's Statement on Farm Issues

I am Bishop Bernard J. Harrington, the Roman Catholic Bishop of the Diocese of Winona, Minnesota. The Diocese covers the 20 counties of Southern Minnesota. I am pleased to have an opportunity to submit these comments on behalf of the Minnesota Catholic Conference and in the name of the Catholic Bishops of the six dioceses of Minnesota

Our perspective is based on our belief in the dignity of all people as they are created in God's image. For people to live a dignified life, they must have an adequate and safe food supply.

For us, food is not just another commodity in the grand economic scheme. It is essentials itself and as such, should be viewed as a common good and not be controlled by a few corporations or by government. For us, food is a moral issue.

How food is produced is also important since we need not only a bountiful harvest, but a safe and sustainable one as well; so care for the land is as critical as what it produces.

These underlying principles – human dignity and human rights, the search for the common good – are what drive our policy priorities. In our view, the basic goal of the food system is to ensure an adequate supply of nutritious food in an environmentally responsible way to meet domestic and international needs and to ensure the social health of our rural communities.

The bishops believe that such a farm system will generate government policies that give priority to small and moderate-sized family farms and the widespread ownership of farmland. In past years we have heard politicians speak about aiding the small to moderate sized family farms. But each time the federal farm bill favors large farms and discriminates against the small family farm. As you formulate the farm bill from your hearing on this issue, we urge you to be guided by principles drawn from the United States

Conference of Catholic bishop's 1986 pastoral letter, Economic Justice for All: "…moderate-sized farms operated by families on a full-time basis should be preserved and their economic viability protected. Similarly, small farms and part-time farming, particularly in areas close to cities, should be encouraged. There is genuine social and economic value in maintaining wide distribution in the ownership of productive property. The democratization of decision making and control of the land resulting from wide distribution of farm ownership are protection against concentration of power and a consequent possible loss of responsiveness to public need in this crucial sector of the economy. Moreover, when those who work in an enterprise also share in its ownership, their active commitment to the purpose of the endeavor and their participation in it are enhanced. Ownership provides incentives for diligence and is a source of an increased sense that the work being done is one's own. This is particularly significant in a sector as vital to human well-being as agriculture.

We are concerned that U.S. agriculture policy does not adequately promote widespread ownership of farmland. In our judgment, current policies have resulted in a concentration of farmland which is detrimental to the interests of farming, to the vitality of rural communities and to the environment. This is a matter of policy choice, not economic inevitability.

We believe that this concentration is a result of farm policy that rewards high yields (achieved by heavy use of chemical inputs) over land stewardship and channels scarce research funds toward chemically and, more recently, biotechnologically based agriculture and away from sustainable and organic farming techniques.

The current system leads to highly capitalized farming operations and the concentration of farmland and ownership (eliminating smaller yet still highly efficient producers). Furthermore, the phenomenon of vertical integration has siphoned off profits from the farmer and given them to the companies that control the other links in the food system: Processors, packagers, marketers and retailers.

In fact, over the last couple of decades the farmer's share of the agricultural dollar has remained flat while the costs of production and the marketing share have increased. Many small and moderate sized farms tied to a major processor or packer have the ability to withstand a smaller profit margin on production because they can make it up in other areas of their business.

We encourage you, therefore, to look seriously at the entire farming system in this country. We believe that we must begin to more carefully craft a system that supports family owned and operated farms that are efficiently run and take advantage of the latest sustainable agriculture technologies.

Toward this end, we offer several general recommendations:

-create more mechanisms for beginning farmers to secure loans.

-shift a substantial portion of research funds away from a conventional chemical-based and more modern biotech-based agricultural system to research that uncovers sustainable farming practices

-continue to analyze the current market system that appears to be vulnerable to manipulation by giant agribusiness companies.

Additionally, there must be more concerted attempts to tie the price farmers get for their produce to the cost of production. We have heard compelling stories of the desperate situations of farmers. Markets must be transparent and fair to all who wish to participate and they must not be open to manipulation by a few large traders. We also noted that with the increasing trend toward contract livestock production, it is essential that such contracts are fair and consistent so the farmer does not assume most of the risk.

Finally, I wish to make clear our concerns for minority farmers who have lost farms at a disproportional rate to non-minority owners. In this same vein, I continue to be concerned about the least among us in the agricultural system: migrant farm workers. There are still many labor abuses perpetuated by some farmers, processors and labor contractors. We enjoy the bounty of the labor of migrant workers. In turn, we need to be sure they are offered decent housing, medical care and freedom to join labor organizations of their choosing without the threat of summary firings or intimidation by the growers and processors.

In summary, these issues involve tremendous moral considerations. The ability to feed a nation and the world safely and sustainably, the long-term health of productive land and the survival of our rural social fabric all depend on this Farm Bill. I thank you for the opportunity to present the views of the Catholic Bishops of Minnesota on these issues.

STATEMENT FROM DEANNA LEDERER.
(5811, Michael Court, St. Cloud. MN 56303)

Time is of essence when considering the rural community. As we talk, communities are losing young people, losing local businesses, losing smaller farmers, closing churches and schools, and being challenged to meet increasing needs. Their population is graying and needs health care, transportation, and other services. The few newcomers are often lower paid and from minority populations so may need help with affordable housing, food, learning English, and other cultural adjustments. The push to "bigger is better" has pitted neighbor against neighbor. Residents are complaining about odors, water problems, health problems, fish kills, etc. The larger and fewer producers do not do as much business in the community. There is extensive distrust of government and its agencies by all parties.

I am strongly urging the state to take a more proactive role with communities. If we wait for all the research to come in, we will be putting out more fires, holding public hearings to rectify bitter complaints that have no adequate solution, and losing out on restoring the health of communities.

The GEIS document aims to look at the impact of animal agriculture on quality of life of individuals and communities. Thanks to you for taking on this tough task.

A healthy Minnesota depends on healthy sustainable communities. Community well being is defined as a high level of social capital. As discussed on page 41 this means trust, mutual reciprocity, a sense of shared future, and the ability to work constructively for the good of the community.

We have enough research and information on healthy communities for the state to act now BUT it must be done in a preventive model, not in a desperate model that allows the worst to happen and then tries to rectify it.

- Community leaders need opportunity for education and information about this GEIS document, about the real costs of animal agriculture and other development, about options for their future, and about policy development. This can be done through state agencies such as the University and Extension.

- Citizens and their leaders need opportunities for dialogue, networking, and coalitions so they can participate in setting community values and developing a community vision. Citizens have a right to be informed about the impact of animal agriculture on their health, economy, and environment so they can make good choices.

- The government through its agencies such as Extension can provide vehicles for communities to network with each other on local, county, and regional levels on successful strategies. I support the consensus item #60 that calls for government to initiate discussion groups, policy seminars, and conferences for producers, community leaders, policy makers, and other state and local stakeholders for discussing issues in animal agriculture and developing mutually acceptable alternatives.

A strong factor in sustainable communities is that the small and mid size farmer needs a market and equitable price in order to survive and have quality of life. This is also crucial to ensuring that diversity of the rural community is a real option. Numbers 62 and 63 need our support since this calls for government support for the smaller producer to meet environment stewardship responsibilities and to add to the sustainability of the community.

Also, the state can do much to encourage and support marketing alternatives for smaller producers. Programs such as Community Supported Agriculture, Buy in MN initiatives, and value added products incentives are examples.

In future GEIS study -The people who are taking the laborer jobs in the food production and in the processing industry need special attention for they also have the right to a livable wage and a decent quality of life. There was not a lot of GEIS information on the quality of life of the laborers and I support inclusion of this population in future updates. Programs that address this issue should be incorporated into the state education and information packages that the state develops.

I support #61, which calls for improved responsiveness and local presence, and coordination of state agencies. Funding must be granted so that their staffs can get to the grass roots level in a proactive manner and rebuild positive relationships. The distrust of government by all stakeholders is something we must respond to.

THE LEAGUE OF WOMEN VOTERS
M I N N E S O T A
550 Rice Street St. Paul, MN 55103

Comments by the League of Women Voters of Minnesota on the Draft Generic Environmental Impact Statement on Animal Agriculture

Presented by Nancy Witta, LWVMN Public Hearing, Earle Brown Center, St. Paul, September 10, 2001

Thank you for allowing me to speak. My name is Nancy Witta and I am speaking on behalf of the League of Women Voters of Minnesota. The League of Women Voters, a nonpartisan political organization, encourages the informed and active participation of citizens in government and influences public policy through education and advocacy.

The LWVMN believes that the state should encourage a system of sustainable agricultural production which provides safe, healthful food and which preserves and protects the state's human and natural agricultural resources and enhances the environment.

We support all GEIS policy recommendations which provide real enforcement (hence real funding) of current laws which protect Minnesota's land, air, and water, human health, and which strengthen this protection.

We strongly support the use of incentives for sustainable farming practices, for contributions to clean water and air, healthy soil and conservation of wildlife and for the preservation of agricultural land. We therefore support policy recommendation #72 which encourages the development of alternative agriculture production systems in MN, and policy recommendation #73 which encourages the use of "Green Payments."

We believe that the subtherapeutic use of antibiotics in food animals is of critical concern: LW VMN is planning a public forum on this issue.

In a democracy it is crucial that citizens be informed. The League believes that the public has a right to know about pollution levels, dangers to health and the environment. Public records should be readily accessible at all governmental levels. We applaud the policy recommendations that call for more public education and participation in matters of public concern relating to feedlots-and this means adequate funding. We are pleased to see proposals that call for complete, consistent reporting of feedlot complaints.

Public money should be devoted to agricultural research, development and technical assistance and such resources should be targeted to developing sustainable agricultural practices and addressing the needs of mid-sized farms.

The LWVMN believes the state should promote the stability of rural communities through community and regional planning, through education (in such things as farm management, marketing, etc), and by assuring livable wages for workers. The League applauds social policy recommendations that encourage community interaction.

The League strongly supports policy recommendation #62: increase funding and information on programs which assist small and mid-size producers to fulfill environmental stewardship responsibilities, and #63 which calls for establishing and promoting marketing alternatives for small-sized producers and those not engaged in contract production.

For reasons of health, both animal and human, as well as concerns for the ethics of animal treatment, the LW VMN strongly supports policy recommendation #65, which establishes humane codes of practice for MN animal agriculture.

Finally, the LWVMN, which strongly supports family- and small- and moderate sized farms, would like to see policy recommendations promoting:

- support for beginning farmers
- innovative practices and crops for moderate- and small-sized farms
- farmer-controlled cooperatives which serve moderate- and small-sized farms
- assurance that corporate farms be held liable for their share of losses, environmental damage, and public health hazards, etc.

Thank you very much. I will provide you with a copy of my comments.

September 6, 2001
Mr. George Johnson
Environmental Quality Board
Room 300, 658 Cedar Street
St. Paul MN 55155

Re: Animal Agriculture GEIS

Animal agriculture is vital to our state, especially in southeastern Minnesota. I commend the CAC and staff for your diligent and persistent efforts in this matter. Thank you for the opportunity to comment on the AAGEIS documents. My comments are based on a preliminary review of the draft documents and attendance at the public meeting in Rochester on September 4.

1. The Starting Point -A Comprehensive Goal

Since the documents will be used for decision-making I believe it is important to clearly state the goal of the efforts right up front in the report. I understand that the process has been value-driven and that various goals are articulated throughout the draft document. However, it would be helpful if a concise summary of the comprehensive goal (which is the foundation for this work) could be stated as the starting point for the AAGEIS. The comprehensive goal could be summarized into three basic categories. Following are examples that might be appropriate. The CAC should create their own statements with their own ownership of the words.

Important Values - The people of Minnesota (through the CAC) have indicated that several fundamental values are important to them and that these values drive their activities, both consciously and unconsciously.

- They want farming (including animal agriculture) and other rural businesses to be profitable.

- They want young people to be actively involved in the continuation of animal agriculture in Minnesota.

- They want to feel good about land stewardship and their involvement in community activities.

- They want healthy environmental conditions for themselves and their families. - They want appropriate government policies.

Support for Important Values - The statements listed above are foundational to the quality of life that they desire for themselves, their families, and their communities. Farmers, rural residents, urbanites, politicians, and government agencies recognize that partnerships, communication, awareness, demonstrations, sound public policy and other associated activities are necessary and must be produced to support the most important aspects of their lives.

Description of the Future - The people of Minnesota envision and expect a future that will sustain their most important values. This is a long-term (50+ year) vision that goes beyond short-term (1-5 year) funding cycles, political tenure, market fluctuations, or weather conditions.

- The people within the state (including farmers and non-farmers) will continue to be seen as committed to nurturing a land stewardship ethic.

- The people will continue to develop and nurture a partnership among various interests related to animal agriculture.

- There will be clean water, minimal soil erosion, reduced flooding, and balanced nutrient usage throughout the state.

- Animals, plants, and people will co-exist in a stable, supportive environment.

- Farmers will be profitable, enjoy farming, and be recognized as good stewards of the land and water.

- Communities will thrive with a diversity of opportunities and resources.

- Communications and community decision-making will be respectful of others.

These goal statements are understood to explain why people are willing to spend time, money, and energy on animal agriculture activities, and they describe what the desired outcome will be. The comprehensive goal is not a wish list, but an expectation. The next step is to relate all recommendations and proposed actions to the comprehensive goal. Existing and proposed actions must be evaluated to see if they support the comprehensive goal and to understand potential stumbling blocks on the road toward the desired outcome. Therefore, a comprehensive goal, with ownership by the people that are directly affected by it, must be the foundational target for the AAGEIS process.

It is understood that more time and conversation are necessary to develop and form ownership of a comprehensive goal. However, as a starting point, a "temporary" comprehensive goal can be used as a preliminary guide for AAGEIS activities.

2. A Broader Perspective

The comprehensive goal (above) describes WHY decisions will be made. The text of the AAGEIS, as I understand it, is to consider possibilities and raise issues relative to the contributions of animal agriculture toward the comprehensive goal. The purpose is not to describe HOW to conduct animal agriculture. It is the decision of each producer to make their own decision about their own operation. In that light, it appears that capital-intensive and technology-intensive approaches to animal agriculture are predominant in the documents. While this approach is preferred and/or promoted by some people it must be recognized that management-intensive and biological-intensive techniques (such as planned grazing) are also valid and appropriate ways to support the comprehensive goal. As stated above, these documents should not be used to tell a producer HOW to conduct animal agriculture. It is not the role of the CAC or the GEIS documents to intentionally or unintentionally steer a producer one way or another. The point is to create and maintain the desired outcome, not to be prescriptive. Therefore, I would like to see broader coverage of the many animal production techniques that are available to farmers.

3. On-going Activities

I understand and appreciate the consensus process that the CAC used to develop the documents. A lot of hard work has taken place and a great deal has been accomplished. At the same time, I believe that this step is one of many on-going steps in the process. Following are suggestions to enable on-going dialogue and related activities.

Identify the issues that were not included in the documents because consensus was not gained among the CAC. What is "left out" can be very significant now and in the future as committed people continue to wrestle with tough and timely issues.

Develop a process to periodically re-visit the issues as changes occur, new issues are raised, clarification is necessary, and/or difficulties are encountered.

An excellent foundation has been created. Let's find ways to build on this foundation for the future.
Thanks again for the dedicated work of the CAC and staff in this process.

Respectfully,
Larry L. Johnson
RR 1 -Box 93A
Winona, MN 55987
507-457-9511

Mark Kotewa
499-220th Ave.
Fairmont, MN 56031
Sept 13, 2001

Dear CAC committee,

I recently attended the public meeting in Mankato. I thought it was a very good meeting. It's interesting that the people who oppose animal agriculture have the same argument at every meeting. It starts with citing an article on how we can get such and such from hogs or from their odor. It's also usually the same people, some of which are more of an 'activist' than just a concerned citizen. A lot of their argument is not science based. Please stick to factual information.

Here is my perspective. I am a fourth generation farmer. I have been in FFA, served 6 years on the county pork producers board, and have received the state award, Swine Honor Roll, also the national award, Pork All American. My wife and I also have been leaders in our 4H club. We have served on church committees and other local boards. I am 44 years old.

My great great Grandfather homesteaded this farm in 1886. There has always been livestock on this farm. However the focus has become more specialized in my career. We operate a 440-acre corn soybean farm with a 400-sow farrow to finish hog operation. The we I mentioned is my wife De De, sons Nick and Ross. Nick is in his first year at Iowa Lakes Community College, his study is Farm Management. Yes, he wants to be a farmer, a 5th generation farmer at that. This is truly good news.

Now how do you suppose a young man can start to build a farm operation? Buy farmland? Our average selling price in Martin County in 2001 is $2068/ acre! Perhaps young farmer programs? The operation must cash flow first. Land only will produce enough income to support $1000/ acre. Talking to our lenders, we've decided to help Nick build a 600 head-finishing bam.

We will sell Nick 5 acres and co-sign a loan. Nick will contract finish pigs for his Dad and work on Dads farm after he is through with college. He will also earn extra income from his barn. In ten years his $ 120,000.00 barn will be paid for. He will have about $ 70,000.00 in equity and have 20 years left to lease the barn. 20 years x $21,000 lease payment = $420,000.00 income. I believe this to be the only way for my son to start to farm, short of waiting for Dad and Mom's inheritance.

As for our own operation. If it weren't for hogs we would not be full time farmers nor would my boys have any opportunity to farm. Its been said by local bankers you need a minimum of 1800 acres to be a full time crop farmer. Your wife will still work off the farm to supplement your income! Think about the schools and churches with 25% less people. Are we better off with a few really big farms? Gross return at $400/ acre is $720,000.00 on an 1800-acre farm. Our gross return on our hog farm is approaching 1 million dollars! We spend a lot of money right in our local town of Fairmont. Tonight I can name 20 local young people that stayed on the farm because of the hog industry. I know there are many more. Isn't this a good thing?

I realize that there needs to be some regulations. Could they be based on common sense and sound science and not just "concerns"? Don't regulate me out of business. I never asked to build a hog bar in the city. But when city folk move to the country, the livestock farmer is the one who has to make all the concessions. Go back to town if you can't stand animal smell once in a while, remember manure is organic.

Someone was fretting about burying all these barns when they are abandoned. Remember how many two-story barns there were 35 years ago? How many did the taxpayers have to bury? 99.9 % were disposed of by the landowner, along with the rest of the building site. I have seen what happens to a manure pit once the building is removed and the pit pumped. The remaining solid manure dries out and can be spread on cropland. Where is the problem here?
The extension educator (his name was Jergen Peters) had a great idea. Disclosures on all abstracts in the agricultural zones saying that you are moving to an agricultural area and there may be smells and dust and traffic and that you accept this as normal and hold harmless those in this industry. Seems more than reasonable.

One thing talked about was phosphate. How does it get into the lakes and rivers? Its called soil movement or erosion. Perhaps, ban the use of the moldboard plow. After all, this machine leaves no residue on the surface to hold the soil. Does any one monitor the use of commercial fertilizers? How much over application is done to city lawns? Or is this too sensitive because it involves all farmers and city dwellers?

America is not a direct democracy in which decisions are made by popular vote. We are a representative democracy in which citizens cede decision-making power to those we elect. Just because you hear a lot of concerns, consider how many people that don't have the slightest idea how livestock is raised. Livestock farmers are very out numbered. Do not let emotional rhetoric sway your decisions and then impose arbitrary regulations, red tape and restrictions. You could ruin animal agriculture in this state.

Sincerely,

Mark Kotewa

George Johnson - GEIS comment for CAC
From: <bvaile@northfield.org>
To: <George.Johnson@state.mn.us>
Date: 9/13/01 2:48PM
Subject: GEIS comment for CAC

Dear Mr. Johnson,

According to Minnesota COACT state's farm business management education program in 1999 reported that AVERAGE SIZE DAIRIES OF 50-70 COWS are financially more efficient than large-scale operations.

Please note this in your GEIS recommendations!

W e need MORE people on the land. The cheapening of agriculture is costing us our TOPSOIL and impoverishing us all.

YOU are our protection. The people request protection from Big Ag.

Your process being chaired by Hugoson leaves serious issues of its integrity. It becomes biased.

The report is dross if it cannot come out AGAINST subtherapeutic use of antibiotics.

I am a 63 year old citizen who served on the LWV's State Agricultural 2 year study.

SUPPORT SUSTAINABLE ALTERNATIVES please.

Thank you.

Sincerely,
Barbara Vaile

From: Barb & Bob Esse <bart@ usIink.net>
To: <George.Johnson@state.mn.us>
Date: 9/16/01 2:32PM
Subject: GEIS

9-16-01

Hi George,

Thanks for the very informative session you helped host in St. Cloud. I thought it triggered a significant exchange of ideas, problems and opportunities that you need to add to the collection.

I had a conversation with someone afterwards relative to "corporate farms".

I would suggest you add some reference in the glossary or somewhere in the front that by law, corporate farms are not allowed in Minnesota. What we see as large farms, are really simply several family members getting together to earn a living.

What I do not understand would be ventures such as ValAdCo. How do they operate in the state when we have these laws on the books?

I would be interested in understanding that better.

Regards,

Bob Esse
MPCA Citizens Board Member

From: <KuhIpork@cs.com>
To: <George.Johnson@state.mn.us>
Date: 9/9/01 7:46PM
Subject: Comments on GEIS-Sept. 9, 2001

In MN Statutes Section 561.19, Subd. 2C4, there isn't any protection from nuisance lawsuits for a swine feedlot with a capacity of over 1,000 AU's as defined in the rules of the pollution control agency for control of pollution from animal feedlots or a cattle feedlot with a capacity of 2,500 animals or more. This is yet another example of where, because animal units are used, each time animal unit number changes for swine the statute should be changed so only swine feedlots with the same number of swine as when the law was passed are protected. Otherwise some feedlots with 33% more swine than the law was intended to protect would be protected. This is certainly not fair. Adding 666 finishing hogs to a feedlot could definitely increase the odor potential of a feedlot.

This is but another case that shows why it would be better for the PCA to use animal numbers instead of animal units. All three of these examples, two I provided in written comments on Sept. 5, 2001 and this one, require action by the legislature & EQB to keep the animal numbers the same.

Thank you.

Respectfully,

Jim Kuhl

September 5, 2001

My name is Jim Kuhl. I am a farmer, live near Belle Plaine and have a small hog operation. Here are some things, relative to animal agriculture, to think about.

All rules, laws, ordinances and regulations are only as good as the competence of the people whose job it is to enact or enforce them. Changes are needed because there are cases where the people responsible for enacting, or enforcing the rules, laws, ordinances, and regulations, are part of the problem. In some cases it has resulted in a feedlot in violation of applicable laws or ordinances that could have a devastating effect on the environment, or a neighbor's property value & quality of life. Effected parties should not have the expense of taking a matter to court just because a person in authority was not competent.

Title 40 Section 122.23, of federal regulations is incorporated into Chapter 7020 animal feedlot regulations by reference. It is a part of 7020 just the same as if the requirements were written into 7020. This is the section of federal regulations that defines and establishes EPA's rules for CAFO's. There are two differences in animal unit numbers assigned to animal types between EPA regulations and State rules (.4au vs. .3au for a finishing hog and 1 au vs. .7au for a dairy heifer). There is a question if the State Legislature can legally assign less stringent animal unit numbers to animal types. This could lead to some confusion since MPCA is required to use EPA animal unit numbers to determine if a feedlot is a CAFO. Presently using state au numbers 750au's, 2500 head of finishing hogs, is considered a CAFO per EPA regulations.

Besides the confusion the new animal unit numbers the state is using, may cause, there are other things to consider. In 1997 the State legislature passed a law requiring certain notification requirements for new or expanding feedlots of 500 animal units or more. At the time 500au's represented 1250 finishing hogs. Now 500au's represents 1667 finishing hogs. For everything to remain the same 500au's would need to be changed to 375au's for finishing hogs. In Oct 1999 animal unit triggers were established, by the EQB as a result of Administrative Law Judge hearings, for when an EAW was mandatory or could be requested. Animal number triggers should be changed to reflect the animal unit number changes unless one believes 33% more finishing hogs or 43% more dairy heifers, can be added to a feedlot without increasing the amount of manure produced. Makes one wonder if the use of animal units instead of animal numbers really makes sense any more. Animal units don't produce manure or have odor, animals do.

Courts (including the Iowa Supreme Court) have ruled right to farm laws only protect a farmer from nuisance lawsuits filed by individuals that moved next to an existing agricultural operation. They are not intended to, nor will they, protect a feedlot owner that establishes or expands a feedlot from lawsuits. Courts have ruled in favor of those filing nuisance lawsuits against a feedlot owner because odor from a new or expanded feedlot crossed property lines and impacting their quality of life & property value. Courts ruled the odor constituted a taking of property without compensation. This means it is extremely important that anyone thinking about establishing or expanding a feedlot use every tool available to assure what they are planning is compatible with the neighborhood. One tool that may be valuable is the OFFSET system for establishing minimum setback distances from the various classes of neighbors.

Many times changing the location of a new feedlot or how manure is managed will be all it takes to make it compatible with the neighborhood. We as farmers and livestock producers can not make decisions to improve our economic well being without considering the impact those decisions will have on the environment or the quality of life and property value of our neighbors. Ignorance of the law is never an acceptable excuse.

Number 12 of the GEIS Consensus Policy Recommendations recommends "continuous improvement and field validation of applicable air emission and air dispersion models". I hope as a result of the GEIS task force recommendations the State Legislature will remove the ban on such research.

Thank You

Jim Kuhl
8875 182nd Street, Belle Plaine, MN 56011 (952-873-0414)

Role of Government Policy Recommendations:

50. We agree that public dialogue is a necessary part of the education program, but farmers also need new opportunities to become involved in planning and zoning issues. Facility siting should be an issue that is developed between the farmer and best site recommendations from the Agency's involved. The public should not be the defining group to make this decision.

51. Agreed

52. As long as the data used is scientific evidence, validated with legitimate research studies, we agree that this information should be integrated into the new feedlot provisions. The public should always be aware of, conclusive, correct facts from legitimate research. We do again stress the need for privacy for the individual producer, though.

53. Agreed

54. Agreed

55. We would not accept a recommendation that contains the language "information considered public". It would need to be specifically spelled out as to what is to remain private and what is to be public record. Farmers have the same rights concerning privacy as other citizens and we feel this right needs to be protected.

56. We feel that not only will the State need to fund more training but also hire and adequately train additional feedlot officers. With only one feedlot officer per county, the permitting process will become impossibly slow, creating even more expense for the farmer.

57. Either MPCA or the designated county should be assigned the responsibility for this task- it should not be an either/or proposition. This slows down the permitting process by not having a clearly defined agency in charge.

58. Agreed

Social and Community Policy Recommendation Section:

59-64. In our opinion, the best written and most carefully thought out set of recommendations. They strive to look at all the groups affected by livestock production and find a viable middle ground where agriculture can co-exist with the environmental, animal welfare and health concerns of an expanding urban population. We were pleased to see that small and middle-sized farming concerns were addressed. We also believe that it should be a priority to increase state agency budgets to deal with these problems on a local level. This was the only group of recommendations that recognized how important economically, a healthy livestock industry is to Minnesota.

Ronald Scherbring

Family Dairy Farm

Minnesota City, MN

POPE COUNTY MOTHERS AND OTHERS CONCERNED FOR HEALTH, INC.
September 14, 2001

George Johnson, GEIS Project Manager
EQB
658 Cedar Street
St. Paul, MN 55155

Dear Mr. Johnson:
RE: Hancock Pro Pork EIS

Now that taxpayer's money from the Minnesota Legislature will pay for a large part of the Hancock Pro Pork EIS, whoever supervises the project should get an outstanding and truthful-not doctored up-EIS.

Since this EIS is mostly public funded, it needs to set the standard for a complete, thorough, and reliable study of impact for major operations. It needs to be a "picture book" example that is easy to read and use by the operators and the regulators.

RE: CAC Consensus Recommendations

Please adhere to feedlot regulations, permitting and enforcement with quick and expensive fines. Fines should accelerate with size of operation.

Minnesota has to get a handle on Land Use, so Minnesota is not one of the major contributors to the
Mississippi River pollution. Even though County pollution is terrible the cumulative affects in the Gulf of Mexico are more serious.

Minnesota cannot be a contributor to pollution 1,500 miles away in the Gulf of Mexico DEAD ZONE.
Sincerely,

Bob P Bowlin, President
P.O. Box 56
Glenwood, MN 56334
Phone 320-634-5681
BPB/lb

TO: MN Planning, Animal Agriculture GEIS
FROM: Charlotte Stephens & Lowell Olson
1127 N 6 Ave, St Cloud MN 56303

DATE: September 7, 2001
RE: Role of Government, Page I of 2

While the role of government in relation to animal agriculture is very difficult and controversial, it is also very important:

in ensuring a safe food supply and protecting human and animal health - in conserving and protecting the environment - land, air, water

in providing funding for research.

It is important to rebuild people's trust and confidence in government's ability to deal with the complexities of annual agriculture. To do this will require:

clear, easy to understand regulations

good research, monitoring, inspection, and enforcement - enough staff to do the jobs that need to be done.

To accomplish this, we support the following CAC consensus policy recommendations:

1. Make a greater effort to inform the public about the public health implications associated with disease occurrence, disease transmission, and antibiotic resistance from animal agriculture...

4. Support research to characterize health effects, quantify source strength, and determine the environmental fate of outputs of animal agriculture that have the highest potential for human health impacts...

8. Require the operator to show compliance through continuous monitoring or mitigation, if a complaint investigation validates the probable exceedance of health standards by emissions or discharges to the environment.

14. Reform the odor complaint process to respond more expediently and require documented notification to the facility owner that a complaint has been received...

17. Encourage/Support the research and development and technology transfer of livestock air quality control technology.

29. Strengthen and improve enforcement efforts against long-term non-compliant facilities...

32. Implement BMP's for all land applications of manure and commercial fertilizer to protect drinking water supplies.

49. Explore ways of enhancing coordination of local government planning and zoning efforts relating to animal agriculture to reduce conflict and avoid duplication of efforts.

57. Conduct periodic inspections of feedlots (MPCA and its delegated county partners). Target the riskiest operations and the most sensitive locations first.

61. Improve responsiveness, local presence, and coordination among state agencies at the most local level through state initiatives and increased funding for staff activities.

Since concentration and consolidation have resulted in more potential problems and complaints from the public, it is understandable that state attention and dollars may focus on larger, more concentrated farms. However, for the same reasons, we believe that it is also extremely important to focus attention and dollars toward alternatives. Therefore we, support the following CAC consensus policy recommendations:

62. Increase finding and information on programs to assist small and mid-size producers to fulfill environmental stewardship responsibilities.

63. Establish and promote marketing alternatives for small-sized producers and those not engaged in contract production.

67. Develop voluntary certification programs that include basic annual welfare standards. Encourage and facilitate marketing of the products of such programs.

72. Encourage the development of alternative agricultural production systems in Minnesota, such as supporting beginning farmers; assisting transitioning farmers; and coordinating production and marketing systems for producers.

73. Encourage and support the use of "Green Payments"...

The GEIS Draft has a good discussion of organic and sustainable production and direct marketing on pages 75-76. We would like to see policy recommendations supporting these alternatives, such as:

Expand the Minnesota Department of Agriculture's Energy and Sustainable Agriculture Program to provide more assistance through grants, loans, and clearinghouse of information on sustainable agriculture methods.

Expand technical assistance and on-site training to help producers develop alternatives to concentrated annual feeding operations.

In conclusion, we commend all those involved in undertaking this ambitious and worthwhile project, and hope that you will be able to improve the GEIS after considering comments from the public.

September 11, 2001
George E. Johnson
Project Manager, Animal Agriculture GEIS
658 Cedar Street Room 300
St. Paul, MN 55155

Subject: Comments on GEIS on Animal Agriculture

Based on my personal observations and experience, I believe it is imperative that any State or County employees with the responsibility and authority to issue permits for feedlots be tested and certified to assure they fully understand the rules, regulations and statutes they are empowered to enforce. It is imperative because if a County and/or State employee makes a mistake, no matter how grievous it may be, or how negative the impact may be on the environment and/or the quality of life or property value of County citizens, the County or MPCA will not take any action, even if the evidence is irrefutable and overwhelming, a feedlot operator has not complied with State and/or local rules, laws or ordinances. This is because a County/State employee is acting as an agent of the County/MPCA when they are issuing permits and the County is the County attorney's client. There should be some way provided, in the statutes, so when a citizen with irrefutable and overwhelming evidence to support fact a feedlot is improperly located and does not have valid permits, does not have to hire a lawyer and take the matter to court to get the feedlot problem that is having a devastating effect on someone's quality of life and/or property value as well as the environment corrected. Perhaps there should be someone that goes around and audits work of County feedlot officers.

Here is an example of an actual case demonstrating what I mean.

Owners of dairy feedlot decide to expand their dairy operation in 1992.

Permit application indicates they want to add a free stall barn directly south of existing feedlot
Note: No site plan included with application. Site evaluation done of planned location by SCS.

Free stall barn, plus holding area, milking parlor, and earthen manure storage basin, not covered in the application, added in 1992 to feedlot in an entirely different location than where site evaluation was done. No SCS site evaluation done of new site.

Note: Free stall barn, holding area, milking parlor orientation reversed. This prompted feedlot operators to change location of the basin to "save money".

Holding area, milking parlor, and earthen basin not on feedlot permit.

Earthen basin not designed or approved by registered professional engineer.

Basin not constructed according to SCS Std 425, even though it was constructed in late 1992.

In May 1994 County feedlot officer wrote a letter to feedlot owners in which he said he approved their earthen manure storage basin. He could not do that since he is not a registered professional engineer.

In July 1996 MPCA notifies feedlot owners their basin must pass certain liner thickness and permeability tests before it can be certified and added to their feedlot permit. Copy of letter sent to County feedlot officer.

In July 1996 County releases County feedlot ordinance.

In December 1996 MPCA approves and certifies earthen manure storage basin, even though required tests were never done.

In January 1997 a new feedlot permit issued, by County Feedlot Officer that includes an increase in animal numbers, the earthen basin and milking parlor even though feedlot operators never submitted a permit application and the required tests on the earthen basin were never done. Holding area never has been listed on a feedlot permit.
Note: Feedlot permit not signed at time of issuance so it was not valid. Signed, undated copy surfaced after this fact was brought to the County's attention. Raises questions of when it was signed.

Conditional Use Permit not applied for by feedlot operators, even though County Feedlot Ordinance required them to do so. Feedlot operator planned to add a building and animals to feedlot in July 1997. New feedlot penny and conditional use permit issued.

In August 1997 feedlot operators by neighbors farm instead of adding the new building and animals to their feedlot. No changes made to the home feedlot so Conditional Use Permit and associated feedlot permit are null and void six months from date Board approved it. (February 1998).

Move animals from unpermitted feedlot they have and from the home farm to dairy farm they purchased.
Neighbors apply for and receive feedlot permit for the dairy farm they purchased.

Removed some old buildings from their home feedlot and put the animals housed there in other buildings on the home farm and the newly purchased farm.

Barn on home farm destroyed by fire in January 2000. Lost 108 calves in fire. That was 38 more calves than their feedlot permit allowed.

Apply for a new feedlot permit for home farm. Permit application indicates they are replacing the barn, destroyed by fire, with a slightly smaller barn, and adding animals. New feedlot permit issued by County feedlot officer.

Note: I) Conditional Use Permit not applied for even though feedlot has over 600 au's and County feedlot ordinance requires them to do so.

2) Adding animals even though the permit application indicates they significantly reduced the square footage of livestock housing in the feedlot.

Build new barn and add animals to their home feedlot in January 2000.
Build a new barn and add animals to feedlot they purchased in February 2000.

Note: 1) Feedlots are adjacent to each other and combined have over 1,100 au's. 2) Animals on both farms owned by same entity. 3) Mandatory EAW not applied for. Required because of phased action rule.

Put animals back into unpermitted feedlot about May.

Home feedlot expanded by adding a heifer barn in May 2001. No application for new feedlot permit made even though Chapter 7020 requires them to do so.

Ask the CAC what they would do if the basin in this example had an estimated capacity of over 4.5 million gallons, never crusted over and was located approximately 300 feet north west of a neighbors house. The odor was so bad it made the neighbors sick, an appraiser had given their professional opinion the neighbors house and property it sets on has no resale value, neighbors cannot get the MPCA or County to take any action because people that work for the County are partly responsible. What if they cannot afford an attorney. Since there are allegations and evidence of County employee incompetence, shouldn't there be something similar to a special prosecutor that could look into these types of cases and make sure corrective action is taken, if warranted?

If you have any questions about the above I can be reached at 952-873-4414. That neighbor is me.

Thank You.
Respectfully,

Jim Kuhl
8875 182nd Street
Belle Plaine, MN. 56011 E mail: kuhlpork(a.)cs.com

September 14, 2001
15290 127th St
Villard, MN 56385

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

RE: Comments on Animal Agriculture GEIS:

Comments on General Observations:

With regards to the shortcomings of MPCA in dealing with farmers to regulate & enforce, the Minnesota Department of Agriculture appears to have a more favorable reputation. The Department of Agriculture not only regulates and enforces but also is willing to find solutions and solve problems to the satisfaction of all parties. It should be considered to shift regulations of animal agriculture to the Minnesota Department of Agriculture.

Comments on major GEIS terms:

#4 "Feedlot on Farm size is inconsequential" This is a very important fact and should be recognized by state and local governments. Language that increases regulations or restricts size or prohibits livestock based on Animal units should be removed from the regulations!

Comments to specific recommendations

#6 FDA and EPA should already be in charge of this.

#8 Monitoring should be done by the regulating agency, not a private organization.

#27 & #3l which is it?

#33 Very concerned about nongovernmental organizations submitting data on surface and ground water.

#34 Very good suggestion! Proven research & science should be the basis for the management and regulation of feedlots.

#36 BW SR should work with current research at the University of Minnesota and Extension to improve the FLEVAL.

#40 Cost share dollars would be better spent it the producers would have the option of not putting the cost share dollars into an old and dated system or an unworkable site for future expansion, but into a site with long term viability. Also there should be a firm policy of no unfunded mandates.

#48(e) Purchasing of the property rights should he the only option for local government if the local, policy is to restrict or prohibit livestock on a producers property.

#48(a) Speaking from personal experience the Ag tiered zoning accomplishes only one thing, it eliminates the opportunity for some producers to expand even though their operations may meet or exceed the county or townships setback requirements. It also denies these producers the right to make proposals on livestock facilities to a Planning Commission regardless of the proposal. In my situation 160 acres of my property was placed in a 4000-acre residential area, an area that has had only a few new homes built within the past 20 years. No new livestock facilities are allowed. There is 480 acres of my land located in the least populated township in Pope County. This area is now zoned "non-intensive ag" and is restricted to lots of no more then 200 animal units. This property exceeds set back requirements for other parts of the county that would allow me to establish a 1000 animal unity facility.

#49 nice idea, in a perfect world. Locally there can be jealousy, fear mongering and politics without oversight of a credible institution or agency with research and facts behind it. Our legislative leaders are proud that they give minimum standards and the rest is left up to "local control." The state sets maximum speed limits. The state needs to also set maximum limits on what local governments can do in regulating livestock.

#55 Language and law should be added to protect farmers form harassment legal or other wise. In my county it is the producers that have cooperated with the permit process that are constantly pressured by people that have copies of the producer’s permits and manure management plans. These people are on a mission to eliminate livestock production in the county.

#62 Who defines small or midsize? In the beef industry 85% of the cattle nationally are feed in lots with capacity greater than 1000 animal units. Would it be reasonable to claim less than 1000 animal units is a "small producer" based on industry practices? Funding should be in place for all producers regardless of size!

#63 Remove the "Small sized."

Not included in the GEIS:

Not mentioned is the current misuse of the EAW and the EIS petition, process and costs. These two tools that should be used to find facts are currently used as a form of harassment and to raise the costs of the over all proposed project to a level that it discourages and prohibits the project. These costs should perhaps be placed on the petitioners or the local or state governments not the producers.

Not mentioned is the cost of the current regulations and increased public scrutiny of livestock producers and their operations. Included should be the economic and emotional toll it has on Animal Agriculture in Minnesota. If current policy in the state and some counties continues there will be no expansion or replacement of livestock operations or the processing plants. I fear that we will gradually lose our livestock and its support industries simply through attrition.

Sincerely,
Ted Reichmann
Livestock Producer

September 12, 2001
27673 County Road 18
Starbuck, MN 56381

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

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Sincerely,

Mike Billehus
Livestock Producer
Pope County Farm Bureau Legislative Chair

Overview of the GEIS Draft Policy Recommendations

Most of the recommendations in the GEIS are intended to limit, regulate, and confine animal agriculture in our State. Farming is a legal, highly regulated, commercial enterprise in Minnesota. Our freedom to farm should not be jeopardized by over regulation due to half-truths, unsubstantiated accusations and fear mongers. We are greatly distressed by the desire of some to make our private records, public knowledge. We support our manure management plans, and other air and water quality documentation be available to the appropriate Government agencies for review and compliance checks as mandated by law. However we object to these private documents becoming public domain. Our right to privacy is not negated simply because we farm.

The Animal Welfare concerns in the original GEIS Draft of Policy Recommendations were certainly the most difficult for our organization to deal with. Even though the final draft contains only a few of the original recommendations, we feel animal welfare recommendations should be made by Experts (farmers, extension agents, vets, USDA, etc), and based on scientific evidence , not by a public that relies on hear say, scare tactics and unsubstantiated statements.

We were extremely disappointed that the Economic recommendations were not released in time for us to complete a thorough study. Although, this should have been a very optimistic part of the GEIS in terms of the positive impact Animal Agriculture has in the State, the paper itself seemed to list only the reasons that it's impact could not be accurately measured. It seems as if the recommendations were simply added on at the end to make a very negative report more appealing to Livestock producers. These recommendations certainly sound attractive, but with all the additional inspections, permits, and limitations in the preceding 68 recommendations. It seems highly unlikely that these will bear truth.

Looking to foreign countries for Code of Practice or any other guidelines assumes that these codes are superior to the ones we currently operate under. Furthermore, Minnesota must compete in predominately domestic market. Code of practice and environmental requirements must not place Minnesota producers at a competitive disadvantage domestically if production livestock is to survive and thrive. Taxpayers in those foreign countries, substantially subsidize the legislated care they ascribe to. It in not feasible or possible to adopt these practices without altering the financial subsidies paid to Minnesota farmers.

These recommendations should have stressed the benefits the State of Minnesota and her population receive by helping to foster a healthy, growing livestock sector. No where in this study do we see the positive benefits of animal agriculture to the State. In particular there is no mention of the money and jobs generated by animal Agriculture or that they are irreplaceable by any other commercial venture.

The alfalfa and pasturelands that feed our animals are the single greatest deterrent to land erosion. The fewer the animal units, the greater the erosion. Manure applied according to approved nutrient management plans are beneficial to soil and save valuable natural resources that would otherwise be used for chemical fertilizers. Americans enjoy the safest and least expensive food supply in the world, with less than eleven cents from every dollar being spent on food. Minnesota farmers are proud to provide a safe abundant food supply to Minnesota consumers.

Those of us that raise livestock and live on our family farms realize more than most that our livelihood depends on clean air and water, responsible care of our animals, and the ability grow and adapt to a changing economic climate. We are acutely aware of the impacts are farms have on our neighbors, the environment, and more recently, tourism in our area.

But as farmers, with the help of Veterinarians. Extension personnel, and the USDA, we are the experts in Animal Agriculture. We are professionals, who strive to protect the environment, care for our animals in away that ensures their welfare and our economic livelihood, and expand and operate our businesses as we see fit.

Respectfully submitted SE MN AG Alliance
Seek a path(s) that Minnesota strive for....

Minnesota Pollution Control Agency Office of the Commissioner VIA FACSIMILE (651) 296-3698

September 14, 2001
George Johnson Project Manager
MN Environmental Quality Board
658 Cedar Street
St. Paul, MN 55155

RE: Minnesota Pollution Control Agency Comments on the Animal Agriculture. Generic Environmental Impact Statement

Dear Mr. Johnson:

The purpose of this correspondence is to enter comments of the Minnesota Pollution Control Agency (MPCA) for the official administrative record of the draft Generic Environmental Impact Statement (GEIS) on Animal Agriculture in Minnesota. The MPCA, as a participant in the development of the GEIS., understands the difficult task the Environmental Quality Board (EQB) had in preparing the GEIS from the extensive technical work that preceded it. Thus, the MPCA offers its comments in an effort to enhance the GEIS both in content and usability.

The MPCA comments focus on issues of policy, technical information and Citizen Advisory Committee (CAC) recommendations. As a result, MPCA comments are presented under the two categories of Policy and Technical Issues. Please note that the MPCA comments are arranged in order of significance based on MPCA review.

POLICY ISSUES

1. **Use of the GEIS**.

A statement is made on page iii of the Executive Summary "This animal agriculture GEIS does not in any way replace the need for a site-specific EAW or EIS on any individual project." While this statement is true, the GEIS. should provide information that answers questions that may have otherwise triggered the need for a discretionary Environmental Assessment Worksheet (EAW) or Environmental Impact Statement (EIS). We should be able to use the GEIS to answer concerns, and sometimes these answers should alleviate the need for a discretionary EAW or EIS. However, the existence of the GEIS does not alleviate a project proposer's obligation to comply with Minnesota environmental review (Minn. Stat. § 116.D).

2. **Review of the Statutory Language Regarding Earthen Swine Manure Basins**

As you are aware, the Minnesota legislature has placed a moratorium on the use of earthen storage systems for swine manure. The moratorium ends six months after the completion of the GEIS (Laws 1998, Chapter 401, Section 52, as amended 2000). The GEIS is intended to inform the final decision on the appropriate use of earthen storage systems for swine facilities. Please expand on this issue in the final GEIS document.

3. **MPCA Relationship with Farmers**.

A statement is made on page 14 that MPCA staff is not used to dealing with farmers. Then the statement is made that MPCA staff "may see the agricultural exemptions in legislation as expressing a "hands off" policy towards farmers." Neither of these statements are factually correct and they should be removed from the report. Many of the MPCA staff working on feedlot issues were raised on farms. Most of the other staff have many years of experience in working directly with farmers. There are no MPCA staff within the feedlot program approaching our new rules and laws with a "hands off" approach towards farmers, as is implied in the report. These opinion statements do not add value to understanding Animal Agriculture and should be removed from the GEIS.

4. **Conflicting Views Among State Agencies**.

A statement is made on page 14 "there have been conflicting views among the state agencies on how to deal with animal feeding operations." For most situations, the state agencies have been in general agreement on how to deal with animal feeding operations. The various state agencies are represented on Feedlot Manure Management Advisory Committee (FMMAC), a legislatively created committee (Minn. Stat. § 17.136). As a result, conflicting views amongst agencies are more rare than common. This statement should be removed or better justified in the GEIS.

5. **Efficient, Environmentally Sound and Effective Feedlot Permitting Process**.

Recommendation #69 states "Develop an efficient, environmentally sound and effective feedlot permitting process that enhances and attracts livestock production." Later in the report, the new feedlot permitting process is described as efficient and environmentally sound, yet it is still too early to tell how effective it will be. It is not clear from the recommendation or the report what changes are needed to the new rules to improve the permitting system to meet the mutually acceptable goals stated in recommendation #69. The MPCA is also concerned that achieving the goal of an efficient feedlot permitting process may come at the expense of environmental protection. Please provide further clarification.

6. **New Technology**.

Page 84 of the GEIS indicates that the new Minnesota feedlot regulations discourage new technology development. The GEIS should note that Minnesota feedlot regulations do allow for new technologies to be proposed and in fact encourage producers to explore innovative technologies. It should also be noted within the GEIS that wide spread successful use of an innovative technology by the industry may ultimately dispense with the special administrative procedures for innovative technology review by the MPCA.

7. **Public Review**.

The GEIS (page 84) states that MPCA rules do not allow for public review when feedlots have less than 1,000 animal units (AU). This statement is incomplete and somewhat misleading. The public has an opportunity to provide comment on livestock projects during the environmental review process and the permitting process.

a. The GEIS should describe the public review and comment for permits that are triggered by EQB environmental review rules. EAWs can be required for feedlots expanding by 500 AU, greater than 1,000 AU, or more in sensitive areas, or when a discretionary EAW is approved. The public has the opportunity to comment specifically on the EAW during the public notice period.

b. The GEIS should include language regarding the ability for public comment on National Pollutant Discharge Elimination System (NPDES) permits for confined animal feeding operations (CAFOs). Currently, all facilities with greater than 1,000 animal units are required to obtain an NPDES permit. Under the NPDES CAFO permitting program, facilities with less than 1,000 animal units may be required to obtain an permit that is placed on notice for public comment. The public may also provide comment during the public notice of NPDES permits.

8. **General Statement on FLEVAL, OFFSET and Related Predictive Tools**.

The draft GEIS discusses the use of a number of modeling tools to assist in the assessment of water and air quality impacts related to livestock production facilities. The

MPCA is concerned that the draft GEIS language is promoting the use of specific tools rather than advocating for a state model approval process that results in a number of approved tools that can be made available to the public at large. The MPCA also believes that some predictive tools are superior to others and the use of certain tools may not be appropriate used for the appropriate application.

TECHNICAL ISSUES

1. **Antibiotic Resistance**.

As discussed during the GEIS CAC meetings, the MPCA strongly supports further research and investigation into the use of antibiotics in livestock production and its relationship to the environment. The GEIS should include further information and direction on this important subject. Antibiotic resistance is an emerging public health crisis facing the 21st century on a global level. Many antibiotics are losing their effectiveness as the target bacteria evolve resistance to them, resulting in fewer drugs available to fight bacterial infection. The fewer the available drugs, the greater the likelihood that infectious diseases will impact the general population, as they did prior to the discovery of antibiotics before World War II. The evidence of antibiotic abuse in the agricultural sector is already manifesting within our food production processes. Strains of Salmonella and other disease-causing organisms found in raw and undercooked meat are increasingly resistant to several antibiotics. This is also a concern as bacteria can transfer resistance genes to unrelated species of bacteria, possibly contributing to resistance problems in a wide variety of pathogens.

MPCA staff has reviewed technical literature that indicates that antibiotics are transported into surface and ground water in areas with animal feeding operations and that land disposal of animal manure could also introduce pharmaceuticals in surface water and in ground water.

The environmental persistence of antibiotics used in livestock production varies, however, even those with short half-lives may be of concern. For example, chemicals that are continually infused to the aquatic environment become `persistent' pollutants even if their half-lives are short as their supply is continually replenished. The ongoing release of antibiotic-containing livestock wastes means that even readily degraded antibiotics act as persistent and potent contaminants in the environment.

2. **Phosphorus-Based Rates in Rules**.

The GEIS does not generally acknowledge that MPCA feedlot rules have phosphorus based manure rate requirements in areas with a higher risk of polluting waters. For example, on page 152, the report states "If P is being applied at rates greater than crop removal rates, soil test P levels could be increasing in those regions, potentially leading to increased P in runoff to surface waters." And on page 154, the GEIS states "present regulations require adequate amounts of land for manure application based on N." Yet no mention is made anywhere that phosphorus build-up is prohibited in high-risk areas. The

GEIS acknowledges that the areas of greatest concern are those areas close to waters, particularly those areas with high soil phosphorus levels close to waters. MPCA rules prohibit long term soil phosphorus build-up near lakes, streams, intermittent streams, certain drainage ditches, and wetlands. The rules also include certain provisions prohibiting excessive soil phosphorus build-up on other lands where manure is applied from feedlots with over 300 animal units. Please include these important facts about Minnesota rules in the discussions pertaining to phosphorus-based rates.

3. **Nitrate Leaching (Liquid vs. Solid Manure)**.

The GEIS states that liquid manure applications cause greater risk for nitrate leaching to tile drains than surface applications of solid manure, especially when liquid manure is injected (page l l4). This is not a true statement. If we consider that with surface application of solid manure, there is less confidence by producers in nitrogen availability to crops; thus, commercial fertilizer is more apt to be over-applied, thereby leading to greater nitrate leaching losses.

4. **Best Management Practices for Land Application of Manure**.

Consensus recommendations 10 and 32 both state that best management practices should be required for land applications of manure and commercial fertilizer. Best Management Practices are already required for land application of manure in the revised Minnesota feedlot regulations. The GEIS should provide the additional practices that should be required and clarify if it is also recommending regulation of commercial fertilizer application.

5. **Manure Management Plans**

The CAC recommends (#27) requiring manure management plans at facilities with over 100 AU and later (#31) recommends that manure management plans be required at facilities between 50 and 300 AU. These recommendations should be made consistent.

The MPCA agrees with the findings in the GEIS that manure application is a significant potential source of nutrient losses to our waters. The EQB should seriously consider additional policy recommendations related to development of manure management plans, as noted below.

1) Local Board of Sail and Water capability for technical assistance needs to be greatly increased, or farmers should be provided with better economic information to justify expenditures on private sector expertise. Government technical assistance and training are insufficient methods to provide farmers with the ability to develop their plans and adjust their plans prior to each cropping year. Farmers are reluctant to hire private sector agronomists due to the costs and sometimes due to minimal availability of experienced experts on this subject.

2) University of Minnesota Extension Service should help facilitate self-demonstration of various manure rates so that farmers can develop the confidence in these rates. Manure management plans must be useful for the producer. All too often they sit on shelves after meeting a government-instituted requirement, thereby providing no environmental or economic advantage. Farmers need to develop confidence in the nutrient rate recommendations made in the plan. Farmers tend to believe results clearly substantiated on their own land. Farmers should be consulted about other ways to make the manure management plans more meaningful.

3) University of Minnesota Extension Service should foster further research and demonstration on how to apply manure at low rates (e.g. 1,500 to 3,000 gallons per acre). Equipment is sometimes not available to apply manure at the rates or ways suggested in a farmer's manure management plan.

4) This University of Minnesota's Manure Application Planner software needs major revisions, updates and ongoing technical support. This software is a computer program for developing a manure management plan that includes an economic optimizer. It is important for government to invest in such tools to help farmers identify savings in commercial fertilizer costs when applying manure on their fields.

6. **Method of Manure Application**.

An apparent inconsistency is found between wording on page 114 and wording on page 121. On page 114, the GEIS states that the method of application does not affect risk of bacteria in surface water, and on pages 121 and 122, it states that injection or incorporation of manure leads to smaller risks for polluting surface water than for all other methods. MPCA staff review of the literature support the conclusions reached on pages 121 and 122. The word "method" should be deleted in the third paragraph on page 114 (3rd sentence).

7. **MPCA Ground Water Studies**.

The MPCA studies described on page 115 state that "all" studies were conducted on coarse-textured soils. This is not true, since only two of the four studies described were conducted on coarse-textured soils. The statement should be changed to read "Much of the monitoring was conducted on coarse-textured soils."

I appreciate the opportunity to provide comment on this important project. If you have questions regarding the MPCA GEIS comments or the feedlot program, please feel free to contact Myrna Halbach, MPCA Willmar Subdistrict Manager, at (320) 214-3794.

Sincerely,
KAS:dmb

cc: Steve Boesacker, Chief of Staff; Commissioner Gene Hugoson, Minnesota Department of Agriculture

Commissioner Jan Malcom, Minnesota Department of Health; Senator Krenz, State of Minnesota
Senator Price, State of Minnesota; Rep. Ozment, State of Minnesota
Rep. Holshiem, State of Minnesota; Senator Dille, State of Minnesota
Senator Scheeval, State of Minnesota; Rep. Finseth, State of Minnesota
Senator Sams, State of Minnesota; Senator Berg, State of Minnesota
Rod Massey, MPCA, North/South Districts
Myrna Halbach, MPCA, Willmar Subdistrict Office Wayne Anderson, MPCA/Saint Paul
Jim Sullivan, MPCA, North/South Districts

From: lmahthe@attglobbl.net
To: <George.johnson@state.mn.us>
Date: 9/8/01 10:20AM

I am writing in regards to Animal Agriculture. I do not raise any livestock but I think we are making it way to hard for people to do that in this state. When I talk to the people who build livestock buildings and they tell me that a lot of the companies are going to Iowa to build because it is a lot easier this concerns me. If people cannot farm in the country where can they farm. Actually there is an answer. From what I have been reading and hearing from people who have been there it is South America. They really want our livestock industry to move down there. In this country the way I understand it hogs eat 52% of the corn raised here. If we let this move to South America what will happen to this country. If you think of all the jobs that this would affect if we lost half of agriculture to South America which I do believe will happen in time. Some of the workers affected would be Feed Mill workers, Truck drivers, Machinery dealership workers, fuel truck drivers, Carpenters that build livestock buildings, Electricians, Well drillers, Plumbers, Salesman that sell to all of these places, county feed lot inspectors. If you add all these people up and look what would happen if they are all out of work then they would not buy Houses, Cars, Insurance, Take Vacations, Borrow money from local banks or put money in either so they would fail along with a lot of small towns.

You can see my point and I am sure think of a much bigger impact of losing our Agriculture to other countries. So I think we need to do what we can to support our farmers. And I see there is concern about farms getting bigger. It has always been that way and it will not stop because the cost of doing business keeps going up and the price we receive stays the same or goes down if you do not keep getting bigger you will not make it on the farm.

In looking at the feedlot laws in place now I think they are very much adequate. The only thing that needs to be addressed is if you tell a farmer here is what you have to do to build a building and meets all the things you told him he should get the permit and be able to build. But I hear there is lots of them denied after they meet all the requirements. This should not be it if there is different requirements then tell them right away.

I am a crop farmer and just want to see Ag stay in this country. I would not like to buy my food from another country that we can't be sure it is safe and reasonable.

Lee Manthei,
14610 586 Ave
Mapleton, MN 56065
507-524-3739

Please excuse the bad spelling

Nicollet County BOARD OF COMMISSIONERS
501 So. Minn. Ave., St. Peter-MN 56082

September 6, 2001

Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN. 55155

Dear Sir:

In reviewing the Draft GEIS on animal agriculture, I referred back to the Scoping Document published in December, 1998. In that document, one of the four objectives of the study was: "identify and assess the environmental, economic, health and social impacts - both positive and negative - associated with animal agriculture as it exists and as it may change, with particular emphasis given to any cumulative effects in the state."

In studying the draft GEIS, I found little positive information about the livestock industry in our state. The study is not complete when there is little or no credence given to the economic value of the industry. I am not an economist, but I can tell you that if we did not have the livestock industry in this state, we would be a much poorer state. When we raise feed grains and feed them to livestock, we have a much more valuable product to sell, i.e. milk, meat, and poultry. The other part of this is the processing industries that go along with the milk, meat, and pork and the jobs they create. The lawmakers and decision makers need to know the full story of the livestock industry in the state. There is more to it than what you have in the draft GEIS.

The recommendations are noble, but we need to consider the benefits received from their implementation compared to the cost of implementing them. The next big question is who will pay. Remember that the legislature is fond of tying the hands of local government by placing levy limits. When they keep asking us to do more, we need the funding to go along with these requests.

Sincerely,

Judy Hanson

Sep 07 01 03:11p

Duncanson Growers
57618 Hwy 30
Mapleton, MN 56065
Phone (507)524-3054 Fax (507)524-4054

Dear George Johnson

Information on animal units from 1945-1998.

	All Hogs Inventory .4 AU=1 hd	Cattle & Claves Inventory 1.1 AU=1hd	Sheep Inventory .1 AU=1 hd	Turkeys raised per year (1) .018 AU=1 bird	Chickens Inventory .01 AU = 1 bird	Broilers Inventory .01 AU = 1 bird	Total Animal Units
1945	1,632,800.00	4,209,700.00	130,500.00	71,262.00	298,440.00	12,480.00	6,355,182.00
1950	1,494,000.00	3,566,200.00	73,600.00	75,762.00	258,670.00	21,193.00	5,489,425.00
1955	1,454,800.00	4,332,900.00	97,500.00	144,288.00	248,950.00	24,630.00	6,303,068.00
1960	1,408,800.00	4,372,500.00	99,900.00	256,500.00	199,050.00	66,190.00	6,402,940.00
1965	1,142,400.00	4,969,800.00	71,300.00	276,630.00	143,340.00	90,200.00	6,693,670.00
1970	1,500,800.00	4,353,800.00	55,400.00	328,788.00	123,360.00	109,520.00	6,471,668.00
1975	1,200,000.00	4,873,000.00	39,000.00	409,536.00	139,670.00	100,920.00	6,762,126.00
1980	2,040,000.00	4,125,000.00	26,400.00	459,000.00	130,000.00	194,000.00	6,974,400.00
1985	1,640,000.00	3,905,000.00	25,500.00	547,200.00	127,000.00	269,000.00	6,513,700.00
1990	1,800,000.00	2,750,000.00	28,500.00	810,000.00	133,000.00	413,000.00	5,934,500.00
1995	1,980,000.00	3,080,000.00	19,000.00	729,000.00	148,000.00	480,000.00	6,436,000.00
1998	2,160,000.00	2,860,000.00	17,000.00	828,000.00	147,300.00	475,000.00	6,487,300.00

(1) Turkeys are calculated by using total annual production. Annual Inventory numbers were not available.

(2) All livestock and poultry population numbers were supplied by MN Agricultural Statistics Service.

(3) Animal unit conversions were calculated by Karl and Pat Duncanson. 507-524-3054 Mapleton, Mn. February 26, 1998.

MINNESOTA CORN GROWERS ASSOCIATION
738 1st Ave East • Shakopee, MN 55379 •
'952-233-0333 • Fax (952) 233 0420 • ww-mncorn.org

September 12,2001

Minnesota Planning Animal Agriculture
GEIS 658 Cedar Street, Room 300
St. Paul, MN 55155

The Minnesota Corn Growers Association submits the following comments on the draft GEIS on animal agriculture. The livestock industry represents about one-half of cash farm receipts for Minnesota farmers. It is the state's largest market for corn, consuming roughly 2/3 of our production. We believe that the significance of this economic impact on our state's economy must be recognized.

Livestock also provide a valuable resource for crop production, a natural fertilizer. A better understanding and recognition of the sustainable cycle exemplified by production agriculture is important to the future of our rural communities, and ultimately the well being of all Minnesota residents. Consumer choice and future sustainability requires that we recognize that livestock produce valuable food products and plant food for use in crop production. Research, education, and incentives ought to work toward better management of all resources on all farms.

The draft GEIS executive summary contains many valuable suggestions. The beginnings of discussion on such social issues as conflict resolution, questions of land use and government policy are of value as we shape our future. We believe that it is possible to produce at high levels while maintaining the quality of our natural resources. Continued research and technology transfer are necessary to meet the needs of the consumer, who has become accustomed to accessing a broad array of products. The MCGA supports the implementation of sound stewardship practices. Historically, research and educational efforts have resulted in adoption of practices that strike the optimal balance between productivity and conservation. Programs to help achieve this balance should be available to farms of all sizes.

There are also several concerns that surface from the executive summary. First, where appropriate regulatory agencies already have jurisdiction, it is problematic to duplicate or supplant the oversight of those agencies. Specifically, we are concerned that granting the MN Department of Health broader authority creates confusion and inefficiency because federal agencies currently exist with authority and expertise in the areas of concern. Second, stewardship is important to livestock and crop producers of all sizes. Targeting programs toward one segment of the industry lessens the effectiveness of the overall effort.

The MCGA agrees with the findings of the Citizen Advisory Committee that we must consider incentives to attract new processing plants and enhance the value of existing plants to support the livestock industry. Local processing also generates significant employment and economic development opportunities for rural communities.

And finally, the MCGA is pleased that the CAC "supports the use of green payments in addition to present U.S. farm policies," which support the production of essential food and energy crops. The CAC goes on to suggest that the state could also play a role in rewarding farmers for using environmentally beneficial practices. This is reflective of our belief that we must maintain a governmental role in assuring a safe, healthy and abundant food supply. Only above this should additional efforts to reward specific practices should be considered.

Sincerely,

Loren Tusa, President

Minnesota Com Growers Association

Minnesota Turkey Growers Association
September 14, 2001

Citizens Advisory Committee
MN Planning, Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Dear Committee Members:

This letter is in response to the request for comments on the Generic Environmental Impact Statement (GEIS) for animal agriculture. These written comments are submitted by the Minnesota Turkey Growers Association (MTGA) in addition to the testimony provided by several of our members at the various public hearings held across the state.

a) All recommendations and any public policy should be based upon sound science.

b) This report should be revised to include the economic, social, and environmental benefits to Minnesota in having a strong animal agriculture sector.

c) We expect that any regulatory or public policy will ensure the privacy of the farmers involved as governed by the Data Privacy Act.

d) Goal of public policy and the EQB in this process should be to maintain and grow animal agriculture industry while maintaining the environment for the greater good of Minnesotans.

e) There are costs associated with all of the recommendations. Decision-makers need to consider who is to pay those costs.

f) We support the creation of new technology to improve animal agriculture production and processing, but any requirement for its implementation should be based on sound science. It must also be practical. and economically feasible.

g) We support the use of education to encourage compliance, we also support enforcement of those individuals that have long-term, chronic, non-compliant facilities/operations.

h) Minnesota, as the nation's largest turkey producing and processing state, raises more turkeys than are consumed by our residents. Of the turkeys raised by our growers, 90 percent are marketed outside of Minnesota with 15 percent of those outside of the United States. Minnesota turkey growers compete on an international level. State policies should not inhibit our farmers' ability to compete in the marketplace.

i) The marketplace and sound science will and should drive the implementation of these and any resulting recommendations.

j) The report does not include any reference to the importance of a strong processing sector in the viability of livestock production operations. Likewise, a strong livestock production system is crucial to maintaining and expanding processing businesses and the associated jobs. The implementation of policies that regulate animal agriculture will impact the supply of raw product to processors thereby having a negative impact on the viability of rural communities dependent upon agricultural processing. This will further erode population and sustainability of rural communities.

k) Everyone has a stake in the environment. If new science unveils changes that must be required to protect the environment, cost sharing must be provided to assist livestock farmers with the costs associated with those changes.

l) Farmers must be allowed the freedom to grow their business (in some cases to remain economically viable and in other cases just because they want to). It should be a livestock farmers right, so long as he or she meets the regulatory criteria of the time, to retain the ability to run his/her business plan. Restrictive regulations that limit a farmer's size, are unfair and must be avoided. We must protect the farmers right to grow if he or she desires to do so.

Comments on Specific Recommendations

#1 Refers to "antibiotic resistance from animal agriculture... ." There has been no scientific proof that link antibiotic resistance in humans to the use of antibiotics in animals. Rather there is strong research that indicates resistance to antibiotics comes from overuse in human medicines. Furthermore, establishing this kind of policy at the state level instead of a federal level will isolate Minnesota's livestock producers from the rest of the nation. Minnesota turkey growers, as is the case with producers of other livestock species, compete in an international market. Creating barriers such as this will limit our ability to compete.

#76 One of the top recommendations from the EQB should be the creation of a sound method of measuring the economic impact of animal agriculture.

#48 Agricultural Zoning and buffers. We support the ability of growers to expand their operations.

Finally, we suggest that the final report include footnotes to briefly describe/clarify acronyms used in the report i.e. FLEVAL, OFFSET, etc.

In closing, we commend the work of the Citizen's Advisory Committee members and the staff. We recognize and appreciate the commitment and effort that CAC members dedicated to this process. In light of the recent terrorist attacks, the process that the CAC undertook is an example of what makes the United States strong.

Please contact us if you have any questions (651/646-4553).

Sincerely,'
Steven H. Olson
Executive Director

Minnesota Farm Bureau Federation
September 13,2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

RE: Comments of the Minnesota Farm Bureau Federation on the Animal Agriculture GEIS

The Minnesota Farm Bureau Federation (MFBF) submits the following comments on the Draft General Environmental Impact Statement on Animal Agriculture.

MFBF is Minnesota's largest general farm organization, representing nearly 16,000 farm families. Our members are concerned about our environment and have a long history of implementing sound conservation practices. MFBF continues to support implementation of incentive-based programs, and believes they are paying significant dividends in improved water quality.

Agriculture has been and continues to be an integral part of the State of Minnesota. In fact, agriculture continues to contribute nearly $8 billion to our economy. The combined value of all livestock and poultry operations within Minnesota is around $4 billion. It is important to note that our crop producers also heavily depend upon livestock producers in providing them a close-to-home market, which is truly a value-added agricultural system. We feel the GEIS does not adequately address the economic contributions, such as jobs and new revenue within communities, ALL livestock facilities have provided to rural areas of Minnesota.

MFBF is concerned that no where in the GEIS are producers given recognition for the benefits they have provided to the environment through prior improvements and/or current best management practices. Farmers have invested significant PRIVATE assets into their facilities to improve their stewardship practices. The GEIS should recognize these investments and outline what a reasonable expectation of private investment should be in the future. The GEIS at times insinuates that large facilities are causing more environmental degradation. However, no where in the report are considerations given to the environmental balance of the agricultural spectrum of the past that included several more livestock operations spread throughout the state, and the environmental impacts those operations had.

We are also concerned that the GEIS does not take into account consumer spending behavior in demanding inexpensive products, which are predominantly purchased through the corporate chain-store supermarket structure. While these issues are sometimes hard to grasp, they are integral to the food system and the comprehensive scope of animal agriculture within Minnesota.

Consumer and marketing variables must be taken into account in relation to the expansion of animal facilities as they relate to vertical integration of our food system. (i.e. producers contracted to processing facilities which in turn are marketing to fewer and fewer food outlets.)

The consumer has the ultimate trump card when it comes to agricultural production and processing. If producers and processors are putting forth products the consumer deems not acceptable, then they will display their displeasure by not purchasing those products. Currently, consumers have the option to buy organic and certified products that meet or achieve their expectation of what they wish to consume. We feel it is inappropriate to set forth the entire agricultural community in a direction that a small segment of the population deems as appropriate.

In relation to concerns over human health, we believe the GEIS is overreaching in its ability to adequately assess the issues. The federal government, namely the Environmental Protection Agency, Food and Drug Administration and Health and Human Services, devote significant time and resources to deal with risk assessment as it relates to antibiotics, hormones, chemical residue and drinking water. We feel the Minnesota Department of Health does not have adequate resources to deal with these issues, and policy recommendations from state agencies will be at risk of being non-scientific, based on emotion and focus too narrowly on segments of agriculture that segments of society deem controversial.

All recommendations within the final GEIS should be carefully considered, as these recommendations will most likely project into a "supposed need" for future regulations. It is important to realize that any future non-cost-share regulatory requirement will place a heavy burden on individual farmers and ranchers as well as distorting the traditional structure of our industry.

Presently, the majority of farmers are not realizing economic benefits as a result of improvements in feedlot facilities. If the consumer and units of government demand environmental improvements and benefits, the GEIS needs to further emphasize the role of consumers and government in providing farmers a premium for their product. One such example would be to further support the state meat inspection program, and work with our federal government in allowing interstate sales of state-inspected meat.

Farmers and ranchers understand the importance of the environment. Their livelihood depends on it. Farmers are more than willing to invest in their operations for common-sense compliance that improves the environment. However, the expenses that are incurred to meet burdensome one-size-fits-all regulations are taking a heavy toll on farm incomes and forcing farmers and ranchers to spread the cost of increased regulation over more units of production. The unintended consequence is the inability of small and medium sized farms to compete in a highly charged regulatory environment.

Therefore, as this study grew out of the controversy of expanding feedlots, it is critical to realize that any ill-founded recommendations that may lead to additional unnecessary regulation may actually be a driving force for future expansion of animal feedlots in Minnesota.

The past record of accomplishment of regulatory action targeted against Minnesota producers shows that additional requirements and restrictions has affected the moderate-sized (those deriving income solely from farming) farmer the greatest. Usually having the effect of the farmer downsizing and taking off-the-farm employment or the farm being sold entirely.

Comments on Specific Recommendations

Human Health Policy Recommendations

#6 - This should be left to the Environmental Protection Agency and Food and Drug Administration as they have authority over the Food Quality Protection Act.

#8 - The regulating agency should be the authority required to conduct continuous monitoring.

#10 - The word "contaminant" should be changed to "nutrient".

#11 - The concept of "higher value" should be given precedence in the development of any livestock identification system.

Air Quality and Odor Policy Recommendations

#15 - Bio-security should be a concern of any independent standardized third party evaluator who visits a farm.

#22 - We oppose a blanket requirement for all open liquid manure storage. "Require" should be replaced with "recommend".

Water Quality Policy Recommendations

#23-Excellent recommendation.

#25 - ”Require" should be replaced with "recommend".

#27 - We feel requiring manure management plans for all feedlots 100 animal units or above is unacceptable. A more acceptable number would be 500 animal units, with authority for the regulatory agency to require plans on smaller operations if problems exist.

#30 - This authority should rest with the Environmental Protection Agency and U.S. Department of Health and Human Services.

#31-Refer to comments on recommendation #27.

#33-Information should only be released in an aggregate form as to protect individuals from harassment.

#35-The term "CAFO" should be deleted.

#42-This recommendation seems vague. If application acreage is not sufficient in the manure management plan, then the manure management plan would simply not be acceptable.

Land Use Policy Recommendations

#46-It is not any units of government role to inform citizens on "lawful methods of redress". Units of government should discourage legal action and work with all stakeholder towards acceptable resolution.

#47-Excellent recommendation. Units of government should form mediation boards to deal with these issues, rather than cases going directly into the courts.

#48(d)-This must be a priority. Real estate agents should be required to inform potential homeowners of the agricultural make-up of an area, and what rural homeowners can and should expect living near agricultural operations before individuals can purchase the home.

#48(g)-Excellent recommendation.

#48(h}-At whose cost?

Roles of Government Policy Recommendations

#55-The confidentiality of individuals must be maintained in order to avoid harassment. Language must be added to deal with the human rights of farmers to have grievance against egregious individuals who verbally, legally and/or evenly physically harass and threaten them.

Social and Community Policy Recommendations

#62-Remove language "small and mid-size". Programs should assist all farmers, regardless of size.

#63-Remove language "small and mid-sized". Programs should assist all farmers who are not engaged in contract production.

Sincerely,

Al Christopherson President

(The following economic analyses were supplied by the Minnesota Department of Agriculture staff for inclusion in the GEIS document.)

Economic Impact of Beef Processing Plant Windom, Minnesota

Summary Highlights

1. This economic impact analysis estimates the economic contribution of the Windom beef processing plant to the local and state economy, especially to the 47-county region, including Big Stone, Blue Earth, Brown, Carver, Chippewa, Cottonwood, Dakota, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Houston, Jackson, Kandiyohi, Lac Qui Parle, Le Seuer, Lincoln, Lyon, Martin, McLeod, Meeker, Mower, Murray, Nicollet, Nobles, Olmsted, Pipestone, Pope, Redwood, Renville, Rice, Rock, Scott, Sibley, Stearns, Steele, Swift, Wabasha, Wadena, Waseca, Watonwan, Winona, Wright,
Yellow Medicine.

2. The analysis is based on two different scenarios:

Scenario 1 - Economic impact of the Windom beef processing plant at current output levels.
Scenario 2- Economic impact after the proposed plant expansion (or 15.7% increase in output).

3. The economic impacts are summarized as follows:

Scenario 1 (At current output level)
Total economic impact: $462.28 million
Total employment impact: 2,811 jobs
Total value-added impact: $130.19 million
Total labor income impact: $82.95 million
Scenario 2 (After plant expansion):
Total economic impact: $538.2 million
Total employment impact: 3,798.2 jobs
Total value-added impact: $155.39 million
Total labor income impact: $99.19 million

Economic Impact of Beef Processing Plant --- Windom, Minnesota (Summary Sheet)

Overall Impact	Scenario 1 (Current output)	Scenario 2 (After plant expansion)
Output Impact ($ Million)		
Direct	185.98	215.15
Indirect	20213	240.32
Induced	69.17	82.73
Total	462.28	538.2
Employment Impact (# of		

Jobs) Direct Indirect Induced Total	177 1,752 882 2,811	672 2,070 1,056 3,798
Value-added Impact ($ Million) Direct Indirect Induced Total	 19.96 68.55 41.67 130.19	 23.09 82.45 49.85 155.39
Labor Income Impact ($ Million) Direct Indirect Induced Total	 16.46 41.98 24.51 82.95	 19.04 50.83 29.32 99.19

Economic Impact of Pork Processing Plant Austin, Minnesota --- Summary/Highlights

l. This economic impact analysis estimates the economic contribution of the Austin Pork processing plant to the local and state economy, especially to the 56-county region, including Becker, Benton, Big Stone, Blue Earth, Brown, Carver, Cass, Clay, Cottonwood, Crow Wing, Dakota, Dodge, Douglas, Faribault, Fillmore, Freeborn, Goodhue, Grant, Hennepin, Jackson, Kanabec, Kandiyohi, Lac Qui Parle Le Sueur, Lincoln, Lyon, Martin, McLeod, Meeker, Mille Lacs, Morrison, Mower, Murray, Nicollet, Nobles, Olmsted, Otter Tail, Pipestone, Polk, Pope, Redwood, Renville, Rice, Rock, Sherburne, Sibley, Steams, Steele, Stevens, Todd, Wabasha, Waseca. Watonwan, Winona, and Wright Counties.

2. The analysis is based on three different scenarios:
Scenario 1 – Economic impact of the Austin pork processing plant at current output levels.
Scenario 2 – Economic impact at 25% output increment.
Scenario 3 – Economic impact at 50% output increment.

3. The economic impacts are summarized as follows:

Scenario 1 (At current output level): Total economic impact: $1,912 million
Total employment impact: 12,220 jobs
Total value-added impact: $544 million
Total labor income impact: $342 million

Scenario 2 (At 25% output increment): Total economic impact: $478 million
Total employment impact: 3,055 jobs
Total value-added impact: $136 million
Total labor income impact: $85 million

Scenario 3 (At 50% output increment): Total economic impact: $956 million
Total employment impact 6,110 jobs
Total value-added impact: $272 million
Total labor income impact: $171 million

Economic Impact of Pork Processing Plant Austin, Minnesota

Overall Impact	Scenario 1 (Current output)	Scenario 2 (25% Output Increment)	Scenario 3 (50% Output Increment)
Output Impact ($ Million)			
Direct	764.4	191.10	382.25
Indirect	860.35	215.09	430.17
Induced	287.52	71.88	143.76

Total	1,912.27	478.07	956.13
Employment Impact (# of Jobs) Direct Indirect Induced Total	 2,897 5,590 3,734 12,220	 724 1397 933 3,055	 1,448 2,795 1,867 6,110
Value-added Impact ($ Million) Direct Indirect Induced Total	 95.48 275.97 172.51 543.96	 23.87 68.99 43.13 135.99	 47.74 137.98 86.26 271.98
Labor Income Impact ($ Million) Direct Indirect Induced Total	 72.2 163.0 101.7 341.9	 19.36 40.75 25.43 85.47	 38.6 81.49 50.886 170.94

Economic Impact of Dairy Processing Plant Zumbrota, Minnesota

Summary Highlights

l. This economic impact analysis estimates the economic contribution of the Zumbrota dairy processing plant to the local and state economy, especially to the 7-county region, including Goodhue, Olmsted, Winona, Wabasha, Dodge, Rice, and Steel counties.

2. The analysis is based on four different scenarios:

Scenario I - Economic impact of the Zumbrota dairy processing plant at current output levels
Scenario 2 - Economic impact at 10% output increment- meaning output either increases or decreases by 10%
Scenario 3 - Economic impact at 20% output increment - meaning output either increases or decreases by 20%
Scenario 4 -- Economic impact at 50% output increment - meaning output either increases or decreases by 50%

3. The economic impacts are summarized as follows:

Scenario 1 (At current output level):
Total economic impact: $223.21 million
Total employment impact: 1,410 jobs
Total value-added impact: $55.37 million
Total tabor income impact: $34.56 million

Scenario 2 (At 10% output increment):
For every 10% increase or decrease in production output, add or subtract:
Total economic impact: 522.31 million
Total employment impact: 141 jobs
Total value-added impact: $5.54 million
Total labor income impact: $3.46 million

Scenario 3 (At 20% output increment).
For every 20% increase or decrease in production output, add or subtract:
Total economic impact: $44.62 million
Total employment impact: 282jobs
Total value-added impact: $11.07 million
Total labor income impact: $6.91 million

Scenario 4 (At 50% output increment).
For every 50% increase or decrease In production output, add or subtract:
Total economic impact: $111.55 million
Total employment impact. 705 jobs

Total value-added impact.	$27.68 million
Total labor income impact:	$17.28 million

Economic Impact of Dairy Processing Plant Zumbrota, Minnesota
(Summary Sheet)

Overall Impact	Scenario 1 (Current output)	Scenario 2 (10% Output Increment)	Scenario 3 (20% Output Increment)	Scenario 4 (50% Output Increment)
Output Impact ($ Million)				
Direct	95.29	9.53	19.06	47.64
Indirect	108.63	10.86	21.73	54.32
Induced	19.19	1.92	3.84	9.59
Total	223.21	22.31	44.62	111.55
Employment Impact (# of				
Jobs)	243.08	24.31	48.62	121.54
Direct	854.05	85.40	170.81	427.02
Indirect	312.59	32.26	62.52	156.30
Induced	1,409.73	140.97	281.95	704.86
Total				
Value-added Impact ($				
Million)	12.63	1.26	2.53	6.31
Direct	30.85	3.09	6.17	15.43
Indirect	11.89	1.19	2.38	5.94
Induced	5537	5.54	11.07	27.68
Total				
Labor Income Impact ($				
Million)	7.27	0.73	1.45	3.64
Direct	20.30	2.03	4.06	10.15
Indirect	6.99	0.70	1.40	3.49
Induced	34.56	3.46	6.91	17.28
Total				

Economic Impact of Dairy Processing Plant Litchfield, Minnesota

Summary/Highlights

1. This economic impact analysis estimates the economic contribution of the Litchfield dairy processing plant to the local and state economy, especially to the 33-county region, including Aitkin, Anoka, Becker, Benton, Brown, Chippewa, Cottonwood, Crow Wing, Douglas, Houston, Isanti, Kanabec, Kandiyohi, Lac qui Parle, McLeod, Meeker, Mille Lacs, Morrison, Nicollet, Otter Tail, Pine, Pope, Redwood, Renville, Sherburne, Sibley, Stearns, Swift, Todd, Wadena, Watonwan, Wright, and Yellow Medicine.

2. The analysis is based on four different scenarios:

Scenario 1 - Economic impact of the Litchfield dairy processing plant at current output levels
Scenario 2 - Economic impact at 10% output increment - meaning output either increases or decreases by 10%
Scenario 3 - Economic impact at 20% output increment-meaning output either increases or decreases by 20%
Scenario 4 - Economic impact at 50% output increment - meaning output either increases or decreases by 50%

3. The economic impacts are summarized as follows:

Scenario 1 (At current output level):
Total economic impact: $585.30 million
Total employment impact 4,399 jobs
Total value-added impact: $181.09 million
Total labor income impact: $113.25 million

Scenario 2 (At 10% output increment):
For every 10% increase or decrease in production output, add or subtract:
Total economic impact: $58.53 million
Total employment impact: 440jobs
Total value-added impact: $18.11 million
Total labor income impact: $11.32 million

Scenario 3 (At 20% output increment):
For every 20°,6 increase or decrease in production output, add or subtract.
Total economic impact: Sl 17.06 million
Total employment impact: 880jobs
'total value-added impact: S36.22 million
Total labor income impact: $22.65 million

Scenario 4 (At 50% output increment):

For every 50% increase or decrease in production output, add or subtract:
Total economic impact: $292.64 million
Total employment impact: 2200 jobs
Total value-added impact: 590.54 million
Total labor income impact: 556.62 million

Economic Impact of Dairy Processing Plant Litchfield, Minnesota
(Summary .Sheet)

Overall Impact	Scenario 1 (Current output)	Scenario 2 (10% Output Increment)	Scenario 3 (20% Output Increment)	Scenario 4 (50% Output Increment)
Output Impact ($ Million)				
Direct	200.06	20.01	40.01	100.03
Indirect	310.78	31.08	62.15	155.38
Induced	74.46	7.44	14.87	37.18
Total	585.3	58.52	117.04	292.6
Employment Impact (# of				
Jobs)	150	15	30	75
Direct	3,055	306	611	1,528
Indirect	1,194	119	239	597
Induced	4,399	440	880	2,200
Total				
Value-added Impact ($				
Million)	28.69	2.87	5.74	14.34
Direct	109.73	10.97	21.94	54.86
Indirect	42.68	4.27	8.53	21.34
Induced	181.09	18.11	36.22	90.54
Total				
Labor Income Impact ($				
Million)	18.07	1.9	3.8	9.49
Direct	69.97	6.91	13.81	34.53
Indirect	25.2	2.52	5.04	12.6
Induced	113.25	11.32	22.65	56.62
Total				

Economic Impact of Dairy Processing Plant Fergus Falls, Minnesota

Summary/Highlights

l. This economic impact analysis estimates the economic contribution of the Fergus Fall. dairy processing plant to the local and state economy, especially to the 10-county region, including Becker, Benton, Cass, Clay, Otter Tail, Pope, Steams, Stevens, Wadena, and Wilkin counties.

2. The analysis is based on three different scenarios:
Scenario 1 - Economic impact of the Fergus Falls dairy processing plant at current output levels
Scenario 2 - Economic impact at 10% output increment - meaning output either increases or decreases by 10%
Scenario 3 - Economic impact at 50% output increment -- meaning output either increases or decreases by 50%

3. The economic impacts are summarized as follows:
Scenario 1 (At current output level): Total economic impact: $117.25 million
Total employment impact: 1,116 jobs
Total value-added impact: $34.3 million
Total labor income impact: $21.4 million

Scenario 2 (At 110% output increment): For every 10% increase or decrease in production output, add or subtract: Total economic impact: $11.7 million
Total employment impact: 112 jobs
Total value-added impact: $3.4 million
Total labor income impact: $2.1 million

Scenario 3 (At 50% output increment):For every 50% increase or decrease in production output, add or subtract: Total economic impact: $58.6 million
Total employment impact: 558 jobs
Total value-added impact: $17.2 million
Total labor income impact: $10.7 million

Economic Impact of Dairy Processing Plant Fergus Falls, Minnesota --- Summary Sheet

Overall Impact	Scenario 1 (Current output)	Scenario 2 (10% Output Increment)	Scenario 3 (50% Output Increment)
Output Impact ($ Million)			
Direct	43	4.4	22
Indirect	61	6.1	30
Induced	13	1.3	6

Total	117	11.7	58.6
Employment Impact (# of Jobs)			
Direct	127	13	63
Indirect	765	77	383
Induced	223	22	112
Total	1,116	112	558
Value-added Impact ($ Million)			
Direct	6	0.6	3.1
Indirect	20	2.0	10.2
Induced	8	0.8	3.8
Total	34	3.4	17.2
Labor Income Impact ($ Million)			
Direct	3.6	0.4	1.8
Indirect	13.3	1.3	6.6
Induced	4.6	0.5	2.3
Total	21.4	2.1	10.7

September 14, 2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St Paul, Mn 55155

RE: Comments of on the Animal Agriculture GETS

I am writing today as a beef producer and a member and volunteer in a number of agricultural organizations in Minnesota including Minnesota Farm Bureau. I have recently had the opportunity to review the Comments of the Minnesota Farm Bureau Federation on the GEIS. I am in full agreement with the statements as stated by Al Christopherson, Farm Bureau President in his letter of August 20, 2001.

In addition I would like to state that I have concerns that certification suggested in Recommendations #67, and #68 are VOLUNTARY, not legislated or mandatory. While we would hope that persons engaged in animal agriculture businesses are educated in their field, and thus qualified to operate their business in a responsible. manner, it does not seem fair to expect them to meet certification requirements that are not required for other businesses in this state. For example do we require that the local grocer be certified in business management?

Agriculture is a major player in the economy of our state. For every person engaged in agriculture production, seven more have jobs in agricultural processing, transporting or marketing enterprises. Farmers and ranchers are responsible entrepreneurs, and business persons, they respect the land, the environment, care for their livestock and give leadership to rural communities. They are willing to invest in their business for common-sense and economically practical management practices that will improve their human, natural and community resources. Resources that we must preserve and rebuild in rural Minnesota.

I urge you to apply a "common sense" yardstick to all recommendations in this document. We are already deluged with legislation that "common sense " dictates.

Sincerely,
Juanita Reed-Boniface
2462 Lake George Dr. NW
Oak Grove, MN 55011

Minnesota COACT's response to the Economics Policy Recommendations (71, 72):

Minnesota COACT believes that Recommendation 71 on funding research for the costs and benefits of animal production is already addressed for dairy. Contradicting the notion that "bigger is better", the state's Farm Business Management Education Program reported in 1999 that the average-size dairy herds of 50 to 70 cows are financially more efficient than large-scale operations due to lower operating costs such as labor and interest on credit. Most of the milk processed in the state is from herds under 100 cows.

Therefore, our recommendation for the GEIS economic policy section is that these most financially efficient farms be maintained and expanded as opposed to large-scale operations. This applies to Recommendation 72 on the development of alternative production. We support help to get more independent farmers started and helping others make the transition to sustainable and organic methods of production. This is less financially risky for producers and lenders than large-scale contracting.

Maintaining and expanding these dairy operations on the land is better for the environment and animal health. They avoid the large concentrations of cows raised in close confinement and huge volumes of liquid manure which breeds disease and pollutes the water and air.

The advent of large-scale feedlots in Minnesota created the need for the GEIS in the first place due to increased pollution, human and animal health risks, and economic insecurity. These problems could be alleviated by maintaining and developing independent family dairy farms as opposed to expansion operations. -

September 6, 2001 St. Cloud, Minnesota

Response to the GEIS report on animal agriculture study.

My name is Jim Kastanek, I am a representative of the Stearns County Dairy Advisory Committee. Stearns County Commissioners appointed 16 members to the advisory committee. The committee is made up of representatives from farmers, agri-business, educators, industry and government.

The mission statement of the advisory group is to "Promote the long term viability of the dairy industry through planning, political advocacy, education and partnerships with producers, business, governments, and residents."

Our first concern is that a favorable climate is maintained for the growth of livestock agriculture in the State of Minnesota. Sometimes through the lack of understanding the nature of the business of livestock production, one can create an unfavorable environment. Example the scheduling of these meetings, one might imply that farmers are not interested because of the lack of their attendance at the meeting. This couldn't be further from the truth. Farmers are extremely concerned about the environment. Why? they live, work, sleep and play in the environment they create. The reason they are not attending these meetings is the time of the meeting.

Our president Jim Gondringer, a dairy farmer is either milking cows during this meeting or chopping silage. Our Vice President Dennis Ritter is also milking cows or chopping silage. If we want the farmers to attend, we have to schedule meetings that don't conflict with their work load or schedule. Holding a meeting from 10:00 am to 3:00 pm would work or after 8:00 pm in the evening.

I am very certain that the planners of these meetings had as an original intent to have all groups of citizens, to have an equal opportunity to present data. The lack of understanding of the farmer's work load and schedule caused this problem. My concern is that without ample livestock producers involved, we will create other issues that may create similar negative climates for our livestock industry to compete in.

Issue #2 if we create regulations more stringent then our neighbors, we will quickly put our livestock producers at a distinct disadvantage. The livestock industry has to compete in national and even global economy.

Example: I have a promotion of South Dakota Private showing of a 1100 dairy unit. The facility is permitted for 2,500 animal units with the State and 1,500 animal units with the County. All permits transfer with the purchase of the property.

South Dakota has the following to offer:

Ample milk processor capacity within convenient hauling distance.

No corporate income tax.

No personal income tax.

No personal property tax.

No business inventory tax. *

Fourth lowest average unemployment insurance rates.

Number one for high school graduation rates in the nation.

Low energy costs.

Some of the best pheasant and goose hunting in the world.

No Corporate income tax: Do you know in Minnesota even if you show a loss for your dairy farm corporation you would have to pay $100-$5,000 of annual tax with your Minnesota return. A 1100 cow unit in Minnesota you could pay $2,000 each extra tax. it is called Fee & Apportionment fee for Minnesota Income.

We already have a disadvantageous climate in the State. Let's make sure we don't make it worst than it already is, otherwise a lot of jobs and cash flow will continue to leave the rural areas and move to other states.

Finally I would like to add our support to the SE MN Ag Alliance, their views and recommendations are consistent with our views. Especially their conclusion which I will read:

IN Conclusion:

Those of us that raise livestock and live on our family farms realize more than most that our livelihood depends on clean air and water, responsible care of our animals, and the ability grow and adapt to a changing economic climate. We are acutely aware of the impacts our farms have on our neighbors, the environment, and more recently, tourism in our area.

But as farmers, with the help of Veterinarians, Extension personnel, and the USDA, WE ARE the experts in Animal Agriculture. We are professionals, who strive to protect the environment, care for our animals in a way that ensures their welfare and our economic livelihood, and expand and operate our businesses as we see fit.

Respectfully submitted SE MN AG Alliance

Thank You, Respectfully submitted
Jim Kastanek

Stearns County Dairy Advisory Committee
Box 366
Albany, MN 56307
Telephone number 320-845-4795

DairyNef2000.com

MEMO
TO: Dairy Industry Professionals
FROM: DairyNet2000.com and AgStar Financial Services
DATE: August 28, 2001
RE: SoDak Dairy Private Showing

Enclosed please find an invitation to a private showing of SoDak Dairy, an 1,100-cow facility, near Letcher, SD. The facility was built in 1998 and is ready to begin milking operations immediately. High moisture grain and corn silage are on hand to begin operations before next year's crop. The facility is permitted for 2,500 animal units with the state of South Dakota and 1,500 animal units with Aurora county. The permits transfer with the purchase of the property. Included in the property are 1,482 near contiguous acres for alfalfa, corn silage, and waste management.

South Dakota has the following to offer:
Ample milk processor capacity within convenient hauling distance.
No corporate income tax.
No personal income tax.
No personal property tax.
No business inventory tax. *
Fourth lowest average unemployment insurance rates.
Number one for high school graduation rates in the nation.
Low energy costs.
Some of the best pheasant and goose hunting in the world.

Informational packets and a proforma cash flow example are available by contacting Wayne Goedken (wgoedken@dairynet2000.com) or Dan Little (dlittle@dairynet2000.com) by email or by calling 888-937-8387.

If you are unable to attend this special showing, but are interested in learning more about this opportunity, please do not hesitate to contact us for an alternate time to view this property.

MINNESOTA Department of Revenue
Fee and Apportionment Schedule
for computing an S corporation's minimum fee and Minnesota source income

SCHEDULE A S corporations
This schedule must be completed by all S corporations.

Business Income apportionment formula (See instructions)

	A In Minn.	B Total	C Ratio (A/B x 100)	D Weighted Factors	E Weighted % (CxD)
(If you conducted all your business in Minnesota during the tax year, complete only column A and enter 100% on line 9.)					
Property owned or used					
1a. average value of inventory	a				
b. Average value of building, etc	b 4,448,814				
c. Average value of land	c 90,700				
Total average value of tangible property owned at original cast (add lines 1a-1c)	**1** 4,539,514				
2 Capitalized rents paid by S corporation (gross rents paid x8)	**2** 687,560				
3 Add lines 1 and 2	**3** 5,227,074		%	0%	
Payroll					
4 Total payroll, including officer's compensation	**4** 396,303		%	0%	
Sales					
5 Sales (including rents received)	**5** 2,522,872		%	0%	
6 Total of lines 3, 4 and 5 in column A	**6** 8,146,249				
7 Adjustments (see instructions)	**7**	(Identify pass-through entity and attach schedule.)			
8 Combine lines 6 and 7	**8** 8,146,249	(This amount is used to determine the minimum fee.)			
Apportionment percentage					
9 Total of lines 3, 4 and 5 in column E					**9** 100.00%

If the S corporation has Minnesota apportionable income on Schedule K (1120S), Iines 1, 2, 3c, 4a-4f, 5, 6, and 8, and nonitemized deduction portions of lines 9 and 10, apply the apportionment percentage on line 9 above to determine the amounts to fill in on Form M-3S-4, lines 1 through 7.

Minimum Fee Table

If the amount on Schedule A, line 8 is:	Fill in on Form M-3S-4, line 14:
Less than $500,000	$ 0
$500,000 to $999,999	$ 100
$1,000,000 to $4,999,999	$ 200
$5,000,000 to $9,999,999	$ 1,000
$10,000,000 to $19,999,999	$ 2,000
$20,000,000 or more	$ 5,000

From: Hartley Clark
To: George Johnson
Date: 9/14/01 12:30PM
Subject: Public comment on draft GEIS for animal agriculture

In speaking at the Rochester meeting for public comment on the animal agriculture GEIS Sept. 4, I stated that the preparers of the GEIS had missed an opportunity to calculate and publish the carrying capacity of Minnesota where the raising of livestock is concerned. You said as I sat down that in other documents there was a treatment of this subject. I do not believe what you said to be true.

Facts as to the carrying capacity of Minnesota are the most important facts you could collect for the GEIS and should have been prominently displayed. If you have in fact developed materials on the carrying capacity of Minnesota you should be able to have a map drawn that shows what areas of Minnesota are populated with animals that are 20% of the local carrying capacity, 30%, 40% etc., 80%, 100 &, 120%, and so on. I would expect such a map to show that southern Martin County is populated with animals more than 100% of its carrying capacity.

We received information in the early 90's from a state agency that showed that Rice County was then at 80% of its carrying capacity of livestock. So I know this kind of calculation can be made. Agronomic rates for mineral application are known for all livestock farms. The cost of transportation is known for transporting manure for spreading. There is nothing to prevent you from calculating carrying capacity, even if you decided to make more than one calculation based on more than one set of assumptions.

From: <ZabeISeeds9aol.com
To: <George.Johnson@state.mn.us>
Date: 9/8/01 8:05PM
Subject: GEIS input- Ed Zabel Plainview, MN

Dear Sirs,

I would like to direct your attention to the section which begins on page 106 , "External costs and benefits of animal agriculture." I was dismayed that there was no mention of spillover benefits. In order to ignore these benefits from animal agriculture you would have to divorce hay and pasture production from the dairy and beef industry and that is not the reality of the situation. The hundreds of thousands of acres of hay and pasture in the state are beneficial in many ways. First of all, established forage grasses and legumes provide a cover crop that is virtually immune to erosion. When the land is rotated to other crops, credit is given in the Universal Soil Loss Equation for two years following the forage crop due to improvements it made in the bulk density and organic matter content of the soil. It is easy to see how on a typical dairy with one third of the acreage in forage production, a large percentage of the farm is benefiting from this effect all of the time.

Phosphorus and other nutrients which are attached to the soil will stay put if soil is not lost to erosion. If this is not a huge spillover benefit I would like to know what constitutes one. It seems to me that this whole section is a classic case of someone looking in the wrong end of the funnel. The big picture is what happens when you take livestock and forages out of the mix. I can take you to some of those farms after a hard rain in the spring and it is not a pretty sight. My recommendation would be to completely change the last two paragraphs on page 110 to adequately reflect the spillover environmental benefits of animal-based agriculture. I would ask that the author's obviously isolationist, vegetarian statements be removed since they have no place in this report.

Minnesota's farmers operate in a global economy and can not be held hostage to the musings of one radical. I would also like to comment on the third paragraph on page 126. The authors are speculating that high phosphorus losses in May are due to manure and fertilizer applied then. A more reasonable explanation is that soil erosion can be high of that time due to the freshly planted fields and lack of crop canopy. Phosphorus is attached to the soil and moves with it during heavy rainfall events. As I alluded to earlier, forage grass and legume production is a premier manner of stopping soil erosion and the resulting phosphorus pollution. In response to the CAC recommendation #25, it should be noted that as soil erosion rates are reduced, the concentration of phosphorus in the soil becomes less of an issue. My concern is that some farms which desperately need livestock and forage production to be sustainable, could be denied that opportunity if an arbitrary P index is required especially if their naturally occurring phosphorus levels were high. Thank you for this opportunity to provide input.

Sincerely,

Ed Zabel

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Plainview,
MN 55964

UNIVERSITY OF MINNESOTA
Southern Research and Outreach Center
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Waseca, MN 56093-4521
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September 11, 2001

George Johnson
Minnesota Environmental Quality Board
658 Cedar Street, Room 300
St. Paul, MN 55155

Dear Mr. Johnson:

Just a quick note to share my observations regarding the GEIS public meeting at Mankato last week. Overall, I thought it was a very depressing meeting with an extremely negative tone being expressed. Many of the livestock producers I saw in the room never said a word. The floor seemed to be occupied primarily by whiners, who were not interested in improving the GEIS process or the final document. They were there to complain about livestock agriculture regardless of the GEIS process. They simply do not want livestock agriculture, as we see it today in their communities and facts or findings will not change their opinions. This closed-mind attitude leads me to question the impact of the GEIS process and its final document.

On a positive note, a few comments and concerns regarding the draft GEIS document were very constructive. First, the economic issues brought up by Judy Hanson, Nicollet County Commissioner, and Dave Pfarr, LeSueur County Extension Educator should be addressed in the GEIS document. Second, the point made by Greg Strobel of "livestock numbers by species from the 50's through present should be presented so that the public knows where changes have and have not occurred" is important. I feel that a historical perspective is always important as one begins to approach and analyze a situation. For instance, when the Metropolitan Airports Commission wants to address airport noise and insulating houses, they assess and document the changes to educate people and develop support for their activities. The same should be done in the Animal Agriculture GEIS. It would greatly strengthen the document and provide educational information to the public. Third, disposal of animal carcasses should be discussed at some length. This is a growing concern among rural residents.

Thanks for reading my comments. I hope they are constructive to the GEIS process.

Gyles W. Randall
Soil Scientist and Professor
GWR:awb

From: hoffman a
Date: 9/14/01 10:42AM
Subject: GEIS on Animal Agriculture

Minnesota Planning written comments on: Animal Agriculture GEIS

My name is Judith Hoffman. I live in Rochester, Minnesota. I am not a farmer, but I am an enthusiastic and life-long consumer of farm products. I also drink water and breathe air on a regular basis. Consequently, I am very concerned about animal agriculture production methods and how they affect farm products, farmers, their families, farms, communities, and, at the end of the line, consumers like me.

I am concerned that the draft GEIS concerns itself pointedly with today's financial bottom line that both farmers and consumers face: attempting to produce cheap food cheaply. I am concerned that corporate agribusiness, accompanied by agricultural higher education, share an expansionist mindset, fostering an almost singular trend toward bigness in all farming practices. I am concerned that solid scientific agricultural research about different farming methods may be compromised because of the ever-tightening link between agricultural companies and university research institutions. The risk of 'privatization" of basic research, as citizen (public) support of higher education drops, is: will the right research questions be asked, and will untoward results be further explored or even shared. I do not raise these concerns lightly (refer to Recommendation #35).

The soundness of the environment must be protected as it is the very foundation of agriculture and agricultural economics. Otherwise, if the environment is permitted to collapse, so will the agricultural economy and the food security of our nation (refer to Recommendation #60).

Minnesota, "Land of 10,000 Lakes," fosters ideation of an endless supply of water. Recent news stories have begun to explore, publicly, the reality that potable water, essential for life, will be increasingly in short supply, potentially sparking crises not only between but within countries. How will U.S. agricultural practices produce enough food for an ever-expanding population while at the same time not draining our aquifers dry or contaminating them beyond reasonable use? How much rain runs off fields rather than replenishing water supplies, causing flooding? How much irrigation water simply evaporates rather than nourishing crops? How much water is withdrawn for use in large-production animal facilities, specifically to capture and to remove animal waste from very large feedlots? Our water resources are like savings accounts - they can be drained dry if not wisely and conservatively managed (refer to Recommendation #33).

At the September 4th draft GEIS public commentary meeting in Rochester, several southeast Minnesota farmers spoke of the "correct fit" of dairy farming for the region's unique conditions: hay and alfalfa crops to conserve soil and water, cow manure as organic fertilizer to build up soil fertility, while another individual brought up the critical concept of "carrying capacity" of regional soils. With the area's karst geology, the margin for error in manure application shrinks significantly. In such a region should agri-economics based on the efficiency of large feedlots drive farming practices, or in specific fragile areas such as this, should other factors, such as water quality protection, take precedence (refer to Recommendation #42)? After all, water must be potable for animals as well as for humans (refer to Recommendation #32).

Useful antibiotics must also be available for both human and animal populations. Currently more than 40% of all antibiotics (recent data demonstrates that this figure is actually 70%I) are used on farms, primarily on "healthy' animals subtherapeutically to promote a small net increment of weight gain. Antibiotic resistant bacteria have been created on farms, spilling over into local water systems, because of such practices. As time passes the probability of resistant bacteria affecting the health of farmers and the general population rises. Successful health care outcomes, of which we in Rochester are so proud, are in part dependent upon effective antibiotics.

Rising health care costs pushed up by infections not amenable to current antibiotics, deaths and illnesses from such infections, costs to research and to develop new, effective, affordable and safe drugs to replace currently over and inappropriately used antibiotics - these costs must be recognized and policies changed (refer to Recommendation #2).

Professor Heffernan, at the University of Missouri, Columbia, has studied the impact of farm consolidation and vertical integration on the health of rural communities. With farms ever increasing in size (becoming too big to fail like some banks and industries?) what does this do to farm policy? Is it, "too big to fail," the driving force behind subsidies to big farms and their farming practices, when more reasonably-sized farms that support independent farmers and their families are more sustainable physically, financially and socially (refer to Recommendation #59)?

Not just today's but also tomorrow's citizens have the right to a healthy, dependable food supply and a physically and socially healthy environment. It has been possible, to this point, to avoid dire consequences from farm practices and policy. But, as population continues to grow, and basic critical resources like water and soil become more scarce and precious (the law, of supply and demand), agricultural policy must be both wisely forged and rigorously implemented.

Thank you to all individuals caught up in this tremendously complex effort to develop an agricultural system that will work for the future as well as for today. Thank you for your huge commitment of time and thought.

Judith Hoffman
2223 Viking Dr. NW
Rochester, MN 55901-3534

Citizen testimony on the Draft GEIS on Animal Agriculture GEIS Draft on Animal Agriculture Comment

Terry VanDerPol
235 Seventh Avenue
Granite Falls, MN 56241
320-564-1877

Thank you for the opportunity to share my reactions to the GEIS. My name is Terry VanDerPol. I'm from Granite Falls, Minnesota. I work part time for the Land Stewardship Project and farm in the upper Minnesota River Valley. I raise primarily grass and forage fed beef and, in partnership, market pasture raised beef, lamb, poultry, pork, eggs and cheese to area consumers, restaurants, groceries and caterers.

The GEIS has succeeded in making some important recommendations-looking at antibiotic abuse, developing a phosphorous index, and stopping the excessive nutrient and pathogen losses into water through tile inlets are among the efforts I applaud.

However, I am profoundly disappointed by the lack of focus on the cumulative impacts of CAFO's. My recollection of the 1998 scoping document of the GEIS raised the issues of cumulative effects. I fail to see the 2001 document addressing it.

Finally, and most seriously, the GEIS has utterly failed in carrying out the charge of the scoping document to look at CAFO's and their social, economic and environmental impacts in the context of the alternative animal production paths. This is my most fundamental objection. The very title of the document should be changed. You have not looked at "animal agriculture", you have looked at CAFO's, Concentrated Animal Feeding Operations. You are once again adding more weight to the false myth that "animal agriculture" means concentrated feedlots, that the only legitimate livestock production operation is a concentrated feedlot.

In the report you try to explain this failure with the argument that there is simply not enough information about alternatives. On page 10, you write, "in terms of the projected matrices, if such matrices (including alternatives) had been prepared for the GEIS, most of the cells of the matrix would be blank." In other words, data and information about the alternative paths to animal agriculture don't fit into the neat tables and graphs we want to include. I'd like to strongly suggest that the tail is wagging the dog.

There are two separate points I would make here.

First, the fact that the data on alternative paths do not fit into your preconceived tables and graphs is precisely why your failure to consider these alternatives is so profoundly egregious. Without a serious consideration of the alternative paths to animal agriculture, you can not ask the questions that need to be asked!! For example, research I have seen strongly suggests that even the best of best management practices will not get us to our water quality goals for nitrogen and phosphorous reduction. To achieve this we must alter our agricultural land use practices, in other words, make changes to our corn/soybean rotation. Alternative paths to animal agriculture lead us directly to deeper crop rotations, to more complex cropping systems.

Different production systems demand different questions be asked. One production system might ask, "How can we handle this by-product, liquid manure, without violating regulatory standards for leeching manure into surface water?" Another production system might ask, "How can we design this livestock operation so the energy and nutrients required to feed the animals goes back as efficiently as possible to nurture the soil that grows the feed?". "How can we keep our neighbors from complaining about the smell?" is a totally different question than, "How can we run this livestock farm so it's a healthy, enjoyable place for us to live and work?" No, the answers to these different sets of questions will not easily fit into the same matrices. The questions being asked are fundamentally different because the goals are fundamentally different. Is the goal a healthy environment in which energy and nutrients are effectively cycled, or is it avoiding the attention of environmental regulatory agencies? I believe the people of Minnesota have the right to expect some insight into the different environmental, social and economic impacts of different paths.

There are ways of making comparisons, ways that might offer some real insight into the differences between the industrial animal agriculture path and the alternatives. There are tools for mapping and analyzing how different agricultural systems cycle critical resources: energy, nutrients, water, human labor and creativity, and money. I believe some of the differences such an analysis would highlight would be of great interest to Minnesotans concerned about their environment, or about the economies of the rural areas.

Second, if the problem you had in meeting the challenge of scoping document to look at alternative paths was a dearth of research, why didn't that finding come through more clearly in your recommendations? In recommendation #59, you urge an "exploration with community leaders, producers and stakeholders of alternatives'. I know when I'm being patted on the head, thrown a bone, and told to "go away". You are right, there is a dearth of research. There are a lot of questions to be answered, a lot of research to be done. So, instead of the GEIS dismissing alternatives to industrialized animal agriculture, how about a strong recommendation to the Legislature that we need to introduce some diversity and fairness into the research agendas of the University and other state institutions? The questions I have as a livestock producer are not being raised by the GEIS process, and by and large, they are not being addressed in publicly funded research.

While your explanation was being crafted, Commissioner Hugoson was doing his level best to gut the only Minnesota Department of Ag program that supports sustainable agriculture. While the report was being drafted the Administration of the University of Minnesota was launching an all out assault on the Minnesota Institute for Sustainable Agriculture. I believe the lack of data and information on alternative paths is not because those alternative are ill-founded or few in number. It is because the powers that be do not want these alternatives to see the light of day. This is not about science. This is about political power preserving the status quo and marginalizing new and creative thought.

The path that this GEIS has taken will help ensure that we will never do better than forcing minimal compliance with minimal environmental regulations. Its "business as usual" (i.e. "Heads in the sand") about the environmental and social of conventional, industrial agriculture. Minnesota's agro-ecological environment deserves better than that, Minnesota's rural communities deserve better than that. The alternative paths are being forged by producers, citizens, and consumers who care. Our work is typically met with hostility, or at best, benign neglect by public and government institutions. I fear Minnesota's GEIS is another verse of the same old song. As I said at the outset, some of your recommendations for research and enforcement are positive steps. But taking the document as a whole, you are just putting earrings on a hog.

4601 Emerson Avenue South
Minneapolis. Minnesota 55409-2339

September 13, 2001

George Johnson
Minnesota Planning
Animal Agriculture GEIS
65S Cedar Street. Room 300
St. Paul, Minnesota 55155

Re: Comments on the Generic Environmental Impact Statement on the Animal Agriculture in Minnesota

Dear Mr. Johnson:

Enclosed for your review and consideration are comments on the above referenced draft document. These comments are submitted on behalf of Sierra Club North Star Chapter, an organization well recognized for environmental protection efforts with a membership exceeding 20,000 people statewide.

Please contact me at (612) 824-4136 if you have any questions regarding this submittal.

Very Truly Yours,

Karen T. Harder,
Executive Committee
Sierra Club, North Star Chapter
Enclosure

Sierra Club North Star Chapter
Comments On The Draft Generic Environmental Impact Statement on Annual Agriculture
September 14, 2001

I. The Citizen Action Committee (CAC) consists of stakeholders, including environmental groups. Only two spots out of 25 are of an environmental nature, one member of which resigned out of frustration. Even though consensus decisions of this group are defined as being supported by 100% of the members, one can easily understand the difficulty of being one against 24 on many issues. This committee is not representative of a true cross-section of stakeholders involved in animal agriculture and it should not be described as such.

2. On page 9, NASS inventory data does not include information on locations of individual feedlots, only aggregates. The inventory is, therefore, still incomplete. A field person should have visited these locations and collected data on these "missing" feedlots. Feedlots should not be in operation without a state or federal permit, or minimally, without a business license. This information should be a matter of public record.

3. On page 10. the implementation component is to be a major recommendation of the GEIS. 'the purpose of the GEIS is to provide background information to help guide future policy and decision-making by the state agencies. Industry representatives should not be driving environmental regulation, as this would be the effect of such an implementation goal.

4. On page 11, the statement is made that "...with respect to project-specific review it should be noted that the existence of economic and social issues concerning large feedlots as documented in the GEIS does not constitute a reason under Minnesota law to deny permits to individual feedlot projects provided they comply with environmental requirements." This is not true. Information contained in the GEIS can be used as supporting material for project-specific EIS reviews. Additionally, if an EIS were to be conducted on a feedlot, socioeconomic issues are indeed one of the decision-making criteria analyzed by the EIS (40 CFR 6.203© and Minn. Ch. 116D.04(e) Subd.2a). Permits can he denied based on the results of an EIS.

5. On page 13, periodic GEIS updates are to be the responsibility of EQB, and specifically not FMMAC. However, if an advisory group is to be formed, the stakeholder groups will overlap entirely. The same individuals, or their alternates, are likely to serve on both committees. These committees would be functionally identical. The suggestion is made, therefore, that such a stakeholders' committee not be formed for this purpose, or if it is, that it not be dominated by industry representatives.

6. On page 15 and throughout various sections of the GEIS, discussion of alternative treatment technology is not pursued. If this document is to address social and economic impacts of the animal agriculture industry in Minnesota, it must also address a technology that is quickly and substantially changing the numbers used in these cost benefit

equations. Manure digesters have been used and studied for many years and are quickly now becoming popular due to current needs for developing renewable energy sources and for reducing air and water pollution from feedlots. Not only does this technology provide a new revenue source for farmers in the state (and nationally) for the production of electricity, but it also significantly cuts odors produced from open-air lagoons and field application systems, reduces pathogens running off fields and into streams, and improves the nutritional value of crops grown on fields treated with digested material. These systems can be designed for both small and large feedlots. The GEIS currently lacks discussion of this technology that has the potential to redirect the way in which feedlots are managed in the state. There is only one sentence that refers to digester technology (page 139, calling it a "promising technology") does not do it justice. To completely ignore `promising technology' that provides a solution to both air and water contamination, and at the same time developing a renewable energy source that provides an additional revenue source to farmers that desperately need it, is not responsible. These are significant economic, social, and environmental impacts of the feedlot industry that cannot be ignored. An additional section of the GEIS should be added to explore these impacts.

7. On page 24, item 58 states that "The legislature should provide guidance and resources ... that includes and encourages local water plans..." This is already accomplished in Minnesota Rules 8410 and 9300, that require water plans of local governmental units, and the Minnesota Board of Water and Soil Resources already administers this program.

8. On pages 78 and 79, complaints made about Surface water quality surpassing air quality as a recognizable and solvable problem disregard the fact that air quality problems associated with feedlots originate from water quality in open-air lagoon treatment systems and the land application of liquid manure. If the odor-causing liquids are treated with a different technology, such as manure digesters, the air quality problem is minimized, and in many cases. resolved.

9. On page 80, it is stated that the 25-year, 24-hour storm event permit exemption in the new NPDES permit rules is eliminated. While essentially correct, this statement is misleading. While the titles did eliminate this exemption, the requirement that CAFO's must contain the 25-year, 24-hour storm event on site was included as a condition of the permit, and doesn't materially change how the rules have been applied since their initial promulgation. This change was made to clarify the NPDES regulations, not cause them to be less stringent.

10. On page 81, the statement is made that a result of EPA being more active on feedlot issues may be that Minnesota could lose part or all of NPDES program delegation, and that this is because Minnesota's new rules are now different from the federal rules. The truth is, many parts of the new Minnesota rules contradicted or are less stringent than the old federal rules. The new Minnesota rules were promulgated despite significant complaint from the environmental community regarding their lack of compliance with existing federal rules (see Attachment).

11. On page 87, the GEIS contains the statement that "There are no mandatory requirements for preparation of EIS's for animal feedlots." While essentially true, this statement is, again, misleading. There are mandatory requirements for the environmental review process, of which EIS's and EAW's are a part. EIS'.s must be done when the determination is made that a project could cause significant environmental impact. PCA hasn't made this determination on any feedlot regardless of size or impact. To say there is no mandatory requirement to do so implies that PCA cannot or should not require it, which simply is not true.

12. Mention should also be made of EPA's extensive AgStar project. Much has been done to study alternative technology, and this is not mentioned at all. The EPA completed a nation-wide study of the effectiveness and feasibility of the use of manure digesters of varying sizes on different types of farms across the country. One of these farms, the Haubenschild Dairy, is in Minnesota and is considered to be an extremely successful application of the system. More recently, an application for a dual-digester facility, Northern Plains Dairy, has been received by the PCA. While the GEIS has devoted only one sentence to this technology, farmers, legislators, and Xcel Energy have all been developing programs to help finance this technology for farmers in Minnesota. It is absolutely essential that the GEIS provide a more adequate and appropriate discussion regarding this technology.

ATTACHMENT to Sierra Club North Star Chapter Letter

November 29, 2000

Francis Lyons Administrator, Region 5

Jo Lynn Traub Director, Water Division, Region 5

Stephen Jann NPDES Permits, Region 5

U. S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60604-3507

RE: State of Minnesota Regulation of Concentrated Animal feeding Operations

Dear Mr. Lyons, Ms. Traub and Mr. Jane:

With this letter, the undersigned respectfully request that the U.S. Environmental Protection Agency (EPA) closely scrutinize recently enacted state legislation regarding regulation of Concentrated Animal Feeding Operations (CAFOs) and the impacts it is having, or will have, on the Minnesota Pollution Control Agency's (MPCA's) regulation of CAFOs subject to National Pollutant Discharge Elimination System (NPDES) permitting.

Unfortunately, due to this legislation that is in direct conflict with federal regulations and non discretionary duties, as well as the MPCA's internal decisions and lack of resources, the MPCA is failing to meet its obligations regarding CAFOs.

It is our understanding that the MPCA is preparing submittals to the EPA regarding its response to the legislation and outlining its Environmental Performance Partnership Agreement. We further understand that these submittals are not yet complete, and long overdue. Since the Minnesota Legislature converses on January 3,2001, we felt it was necessary to express our concerns now and seek a quick response from the EPA, if any amendments to the legislation in question are to be achieved this session.

The following assertions and documentary materials respond to the Criteria for the Withdrawal of State Water Quality Programs set forth in the Code of Federal Regulations, Title 40 Chapter 1 (EPA) Subpart D, Section 123.63 (40CFR123.63). We believe that two of the listed criteria are clearly met in Minnesota's situation:

A. Action by the state legislature limiting State authorities; and

B. Failure to inspect and monitor activities subject to regulation.

(123.63 (a) (1)) Where the State's legal authority no longer meets the requirements of this part, including:

(ii) Action by a State legislature or court striking down or limiting State authorities.

During Minnesota's 2000 legislative session, a bill was introduced that severely limited the ability of the MPCA to address pollution from CAFOs, and that contained provisions in direct conflict with the Code of Federal Regulations. The EPA expressed strong concern about many of these provisions in a letter to Rod Massey of the MPCA from Jo Lynn Traub, Director of EPA Region 5 Water Division (See attached.)

This letter was widely circulated among legislators in an attempt to moderate the bill. Such moderation did not occur. In fact, the House voted down an amendment which provided that in the event of a conflict between the bill and the minimum environmental protection provisions of the federal Clean Water Act or other federal law or regulation, the federal law or regulation would govern. (See attached.)

The bill was enacted, and has been codified as Chapter 435 (attached). This law limits the authority of the MPCA in several ways relative to NPDES permitting of CAFOs.

Subd. 4a: This provision establishes animal unit conversion factors that are less stringent than the factors found at 40 CFR 122, Appendix B for: mature dairy cows under 1,000 pounds, mature dairy cow/calf pairs, feeder cattle, swine between 55 and 300 pounds, horses, chickens with dry manure systems, turkeys under five pounds, and ducks. The MFCA has chosen to use the state animal unit conversion factors when reviewing permit applications and issuing permits. (See attached June 22, 2000, Feedlot and Manure Management Advisory Committee minutes, page 3.) It has also recalculated the number of animal units at existing CAFOs, dropping the state's total of 808 facilities with 1,000 or more animal units per the CFR to 600 per the state conversion factors. As a result, many CAFOs have been excluded from the Minnesota NPDES permitting program that are subject to the Federal NPDES program. This also means that citizens are deprived of a public notice, comment period and right to request a contested case hearing for permits issued which should be NPDES permits, but are not.

Unfortunately, the MPCA is not keeping any central record of permits issued for facilities with 1,000 + animal units under federal rule, but with fewer than 1,000 animal units under the legislation. According to the MPCA, this information is dispersed in regional MPCA offices and in the 50 or so counties delegated to issue permits in MPCA's stead, and is unavailable to either the MPCA central office or us at this time. As a result, citizens cannot access information about where, when and how often this has happened. It appears the MPCA does not want this information to be accessible to the public.

Subd. 7 (b): This provision establishes a 60-day deadline for the MPCA to act on a complete application for an NPDES permit. If the Agency fails to do so, the permit is deemed approved, and automatically issues. This means that the "NPDES permit" may not have received adequate MPCA review, and may not contain conditions needed to implement Clean Water Act standards for pollution control, and therefore not conform to 40 CFR 123.25(a)(12) and (14) through (19).

The MPCA is unable to meet this deadline, by its own admission.

"After examining the deadline requirements, the MPCA concludes that it cannot meet the deadlines under Minnesota Statutes section 15.99, for the majority of feedlot applications. Changing the requirement to section 15.992 [which allows for delays caused by environmental review], an addition of 12 FTEs, and additional county resources are all necessary to fulfill the MPCA's public policy goal of timely and balanced review of feedlot permits.'"

We have no reason to believe that the Minnesota Legislature will alleviate this problem, since the most recent resource allocation initiative by the MPCA, to be granted additional permit fee authority in the 1999 session, was defeated following a campaign led by the Minnesota Turkey Growers Association. Increased funding by the state's General Fund looks bleak as well, since Governor Ventura has told state agencies to cut their budgets.

Subd. 7 (m): This provision prohibits the MPCA from imposing conditions in NPDES permits that are not "specifically required by law or agreed to by the feedlot operator."

This provision is highly ambiguous. the MI'CA feels that the broad requirements of law provide it the leeway necessary to derive conditions needed to meet the law (e.g., where the law states no discharge except in the 25-year, 24-hour storm event, the MPCA may then impose a condition to install and regularly read a level gauge in a manure storage basin). However, state Senate and House authors of this legislation, both during session hearings and in forums following enactment, have stated that the emphasis is on specifically listed conditions (e.g., if the requirement for a basin gauge is not listed specifically in rule or law, the MPCA cannot impose it through a permit).

The effect of this provision, if implemented according to its authors, is to limit the MPCA's clear authority to impose conditions in NPDES permits required by 40 CFR 122.44.

Subd. 7 (p): This provision prohibits the MPCA from establishing conditions in NPDES permits and enforcement orders for non-compliant operations if the cost to comply would exceed $3,000 for AFOs under 300 animal units, or $10,000 for AFOs between 300 and 500 animal units, unless public subsidies pay 75 percent of the cost. (Note: animal units calculated under the state's less stringent conversion factors.)

Concurrent legislation to increase cost-share monies for feedlots such that the 75 percent subsidy would be available was killed in committee. The Minnesota Department of Agriculture is currently studying the level of subsidy needed to bring these operations into compliance.

The effect of this provision is to limit the MPCA's authority to require AFOs with 300-500 animal units that are defined as CAFOs under 40 CFR 122.23 (b), and AFOs with fewer than 300 animal units that may be designated as CAFOs per a case-by-case determination under 40 CFR 122.23 (c) to meet the effluent standards of the Clean Water Act.

Again, the MPCA is not keeping a record of the instances in which this provision is prohibiting clean up due to lack of public subsidies.

Section 10 (c) (4). This provision prohibits the MPCA from regulating CAFO and AFO discharges of process-generated wastewater, unless it contains manure. This would exempt from the Minnesota NPDES permitting program various point source discharges of, for example, silage runoff, milk house wastes, and facility wash water containing disinfectants and antibiotics.

This is contrary to 40 CFR 123.1 (g) (1) and 40 CFR 123.25 (a) (6).

B. (123.63 (a)(3)) Where the State's enforcement program fails to comply with the requirements of this part, including: (iii) Failure to inspect and monitor activities subject to regulation.

The MPCA does not have an adequate program to: identify CAFOs subject to NPDES permitting; periodically inspect CAFOs to determine compliance; respond to and utilize information from the public regarding possible CAFO violations; or maintain a management information system that supports compliance evaluation. All of these program components are required by 40 CFR § 123.26. In 1999, the Minnesota Office of the Legislative Auditor released a comprehensive program audit of the regulation of animal feedlots by the MPCA. It found the MPCA to be seriously lacking in each of these four areas.

Unfortunately, the MPCA has not addressed the problems uncovered by the Legislative Auditor. Rather, the agency revised its feedlot program with the express goal to "Make the feedlot program compatible with existing agency and county resources." The findings of the Legislative Auditor regarding the MPCA's failure to meet the requirements of 40 CFR § 123.26 include:

Failure to Identify CAFOs Subject to NPDES Permitting

"We found that there are significant deficiencies in MPCA's oversight of feedlots on an ongoing basis. For example: There is no statewide inventory of feedlots. . . . The MPCA does not attempt to identify feedlots needing permits that have failed to apply for and obtain permits '"

Failure to Inspect CAFOs to Determine Compliance

Again, a blunt finding from the Legislative Auditor:

"MPCA does not conduct periodic inspections of feedlots once they are in operation. A facility is likely to be inspected only if it is the subject of a complaint or an enforcement action.'"

Failure to Ensure Consideration of Information from the Public on Possible Violations

Another finding by the Legislative Auditor:

"We attempted to review MPCA's complaint file to determine how quickly and thoroughly the agency responded to complaints about water quality.... We found that MPCA does not adequately keep records of water quality complaints relating to feedlots, so we were unable to systematically analyze the agency's timeliness and thoroughness of complaint investigations.'"

Failure to Maintain A Management Information System That Supports Compliance Evaluation

As evident in the above quote, the Legislative Auditors program evaluators were stymied by the MPCA's lack of a coherent complaint log. Among their related findings relative to information systems:

"MPCA started to keep a [water quality] complaint log in April 1997, but not all feedlot staff have been using it. Also, the log does not always identify the feedlot owner's name, dates of MPCA inspections, the specific actions taken, and the ultimate outcome of the investigation. . . . MPCA staff were also unable to provide us with files relating to some of its complaint investigations and the files we did review contained very little information."

"MPCA has no way to track when feedlots are closed and has insufficient staff resources to check on whether closed feedlots are cleaned up in a timely manner."

"Often no written record of the required "karst review" was on file for feedlots built in southeastern Minnesota.

“MPCA does not adequately follow up on interim permits. MPCA has several file cabinets full of interim permits, many of which have expired. Our sample of interim permit is full of interim permits, many of which have expired. Our sample of interim permits revealed that more than two-thirds had expired at some point."

"MPCA does not have a formal system of assigning [enforcement] cases to staff and managing the progress of cases.'

An additional missing piece of an information system is the lack of a central record of inspections. This makes it impossible to gauge whether the MPCA is adequately responding with enforcement actions based on the universe of pollution problems found.

SUMMARY

We believe that the problems detailed above add up to a Minnesota NPDES program for CAFO. that is insufficient to protect water quality and the health of Minnesotans who recreate in these waters.

Due to the actions and tone of the Minnesota Legislature, and to decisions by the MPCA, this situation can only be remedied through the quick intervention by the U.S. Environmental Protection Agency. We respectfully request that the EPA closely review Minnesota Laws Chapter 435, its implementation by the MPCA, and the likelihood of MPCA's resource contingencies being met by the legislature, and intervene quickly if you find that legislative changes and/or amendments to the Environmental Performance Partnership Agreement are needed.
We are very concerned about future actions an emboldened Minnesota Legislature alight make next session if their experience shows that they can thumb their nose at federal law without reprisal.

One or more designated representatives of the undersigned will call to discuss these concerns with Stephen Jann in the first week of January, unless otherwise directed by EPA. If you have any questions or concerns regarding this letter, please call Kris Sigford, Minnesota Center for Environmental Advocacy, at 651-223-5969.

Thank you for your consideration of these matters.

Kris Sigford for:
Clean Water Action

Environmental Friends of Minnesota
Institute for Agriculture and Trade Policy
EIC,Inc.
Izaak Walton League of America
Land Stewardship Project
Mankato Area Environmentalists
Minnesota Center for Environmental Advocacy
Minnesota Lakes Association

Pope County Mothers and Others Concerned for Health
School Sisters of Notre Dame, Center for Earth Spirituality
Sierra Club, North Star Chapter

'Minnesota Pollution Control Agency, Statement of Need and Reasonableness In The Matter of Proposed Amendments to Minnesota Rules Chapters 7001, 7002 and 7020 Relating to Animal Feedlots, Storage, Transportation, and Utilization of Animal Manure, December 8, 1999, page 22.
'Office of the Legislative Auditor, State of Minnesota, Animal Feedlot Regulation, A Program Evaluation Report, January 1999, page 40.

The MPCA issues interim permits to facilities with discharge problems (many of which are probably CAFOs under 40 CPR 122.23 (b)) and to new or expanding CAFOs of 1,000 animal units or greater. Therefore, this finding of lack of follow-up on expired interim permits is likely to apply to many facilities needing an NPDES permit.

All five quotes from Legislative Auditor's report.

From: "Steve Drazkowski"
To: George.Johnson
Date: 9/13/01 4:57PM
Subject: GEIS Comments

George,

My comments are included below. I will email you the photos under separate cover. I will also fax this text to you. Thanks! Steve.

September 13, 2001

Minnesota Planning
Animal Agriculture GEIS
656 Cedar Street, Room 300
St. Paul, MN 55155

Dear GEIS Staff,

I was unable to attend one of the public comment sessions to provide my input to the GE IS, so I am offering my comments to you in written form.

Since the GEIS draft document is so large (204 pages) and covers a wide array of topics, my discussion will have its primary focus relating to the environmental impacts of animal agriculture.

As I read through the water quality and soils sections, I noticed that you have missed one VERY important scoping question, completely. That question is "To what extent does livestock agriculture have a positive effect on the environment?" Other related questions would include questions like "What positive impacts does ruminant agriculture have on the sustainability of soil resources, on erosion reduction, on P and N movement to surface waters?"

Although the GEIS study did a good job at looking at components of the issue, one by one, it failed to ask these questions and did not consider farming systems in its analysis of the issues.

In southeastern Minnesota, our topography is completely different than that of any other part of the state. Counties included in this grouping include Wabasha, Goodhue, Winona, Houston, Fillmore, and parts of Olmsted. In these counties, livestock production, specifically ruminant-based livestock, are the centerpiece of the agriculture systems that are currently in operation. We continue to lose more livestock farmers. Increased environmental regulation (i.e. new state feedlot rules) threatens to pressure these farms even further, which will likely lead to more livestock agriculture that is lost in our part of the state.

I have been on many farms in Wabasha and surrounding counties. A tour of the rural Lake City area this week was indicative of the unbelievable environmental damage that is attributed to the loss of ruminant livestock operations in our county. The hills on those farms, even though they were once contour stripped with grassed waterways, are planted completely to corn and soybeans. Massive erosion is extremely noticeable on these farms - even perceived from a distance in a mature corn field - on farms that once were managed by operators that were honored with the county 'conservation farm of the year."

So what happened on these farms? Well, ruminant livestock operations require forage, usually in the form of alfalfa and pasture. Alfalfa is the centerpiece of contour stripping efforts - it aggressively slows down water movement and limits erosion to levels that are acceptable. Pastureland retards erosion immensely. When these livestock operations leave, the alfalfa and pasture leave also. In their place, the operators plant corn and soybeans, fencerow to fencerow. These operators may be the same farmers that sold their livestock, but more and more often these farms are operated by neighbors or sometimes other, very large operators who run thousands of acres. These "crop" farmers don't use forages in their cropping plans. They don't recognize grassed waterways. They dig up contour strips and plant entire hills or series of hills to one crop.
It's sad to say, but the reality is this: When ruminant livestock operations leave, environmental problems are exacerbated.

Not only do these conditions threaten the sustainability of local farmland, but the pollution of surface water is increased significantly. Whether the nutrients (BOD, P, N, sedimentation, etc.) are originally borne of the soil, inorganic fertilizer applied to the soil, or manure applied to the soil, the massive erosion that the associated change in cropping system introduces yields the exact same result: surface water pollution.

It is my professional observation that in southeastern Minnesota, ruminant livestock operations have prevented massive amounts of pollution over the past decades. The goal needs to be to use exhaustive efforts to retain and increase the numbers of these environmental assets so that we can reduce pollution levels even more.

I will email you photos that I have taken of erosion in Wabasha County farm fields over the past two summers (June). These photos clearly illustrate the phenomenon that presents itself when the ruminant livestock-based system is forced off of the land in our part of the state. I would be happy to address these issues further. Feel free to contact me at your leisure.

Enthusiastically yours,

Steve Drazkowski,
Extension Educator
University of Minnesota Extension Service,
Wabasha County
611 Broadway Avenue 440
Wabasha, MN 55981

(651) 565-2662 (local)
(800) 385-3103 (toll-free)
(651) 565-2664 (fax

Minnesota Board of Soil and Water Resource
One West Water Street, Suite 200
St. Paul, MN 55107
P – 651-296-3767
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September 13, 2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Re: Comments on Draft GEIS on Animal Agriculture

The many people involved in this major effort should be commended for helping to complete a valuable study and report. Although the report does not answer all of the questions raised in the scoping document, it appears to achieve the major goals of bringing together and summarizing a wealth of information, identifying information gaps and integrating many perspectives in its recommendations for future actions. Having a more common and comprehensive base of understanding about animal agriculture should be a substantial asset to the many people involved with this industry in Minnesota.

Following are comments on the draft GEIS, organized by chapters.

Role of Government

1) This chapter and associated recommendations could speak more clearly about the role of government in promoting and providing information sets that help private and public decision makers make the best decisions. Examples include feedlot inventory data, digital soil survey data, soil nutrient data, demographic data, wind data, sinkhole probability maps, wellhead protection information and information about other special protection areas. Good information and early coordination are keys to avoiding permitting disputes and poor land use decisions for new and expanding livestock operations, as well as for fixing existing feedlot pollution problems. Geographic information systems can be powerful decision aids, if reliable data layers are available. The GEIS advanced this approach to providing data layers that project proposers and responsible government units for environmental review are unable, or unlikely, to develop for individual projects. More could be done in this regard, with priorities based on the value of different data sets for multiple uses, including feedlots.

2) Page 75, Organic and Sustainable Production and Direct Marketing: Suggest rewriting the third sentence of the last paragraph on this page to read as follows. "Currently, there are well developed programs in place to help a farmer build a new manure storage or feedlot runoff project, if the project addresses an existing

environmental problem. State and federal cost-share, loan and engineering assistance programs can help design, construct and finance such projects."

3) Page 76, Financial Assistance/Incentive Programs: Please revise "Board of Soil and Water Resources" to read "Board of Water and Soil Resources".

4) Page 77, State Cost-Share Program: This paragraph should mention the $50,000 limit per project for state feedlot cost-share. Suggest replacing the second and third to the last sentences of this paragraph with: "To be eligible for funding, feedlot pollution abatement practices must be on an approved conservation practice list. This list is approximately the same as for the federal cost-share program (EQIP)."

5) Page 77, Observations on Impacts and Effectiveness of State Funding Programs: Although there may not be published "reports" on the effectiveness of the state cost-share program, there is pertinent information available. The LGU Annual Reporting System (LARS) developed by the BWSR, in collaboration with other agencies and the U of M, includes pollution crediting estimates for many conservation practices, including feedlot pollution abatement practices. The BWSR has a number of GIS products and fact sheets summarizing these pollution crediting outcomes for recent years. The BWSR is also leading development of a next generation electronic system for conservation practice planning, implementation and reporting.

6) Page 8l, Observations on Impacts and Effectiveness: The last sentence of the second paragraph under this heading should be revised to reflect that the EPA and USDA published a unified national strategy for animal feeding operations in March 1999.

7) CAC Consensus Policy Recommendation 53: One of the roles of the Feedlot and Manure Management Advisory Committee (FMMAC), which involves many state and federal agencies, local units of government, producer groups and environmental interest groups, is to help develop associated research priorities. This recommendation and chapter do not address the role of government in facilitating communication, coordination, prioritization and consensus building through the FMMAC.

Water Quality

I) This chapter appears to provide much useful information for putting current manure storage and application methods in perspective with other nutrient sources and various water quality risks.

2) CAC Consensus Policy Recommendation 25: It is not clear if this recommendation is to require use of the P index and P needs for a particular crop or soil type as an across-the-board requirement, or as a recommended tool, for manure and chemical fertilizer application.

3) Recommendations 27 and 3l: These recommendations seem to conflict concerning the threshold feedlot size for which a manure management plan would be required (i.e. 100 or 50 animal units).

4) Recommendation 35: Is this recommendation intended to apply to only CAFOs, or both AFOs and CAFOs?

5) Recommendation 36: although the BWSR developed a more user-friendly version of the FLEval model, the federal Agricultural Research Service developed the model methodology for the MPCA and USDA-NRCS. BWSR staff is of the opinion that the model is accurate for its intended purpose of feedlot water quality management prioritization and can be a useful tool to assist in alternative selection for feedlot pollution abatement. Justin Jeffery, a shared NRCS/B W SR employee until June 30, 2001, prepared additional guidance for using the FLEval model that addresses discharge point selection and a number of other topics. This guidance has been distributed to many users of the model. The most important need of the model is to update it from a DOS-based to Windows-based operating system. A joint team of UMES, NRCS and BWSR staff recently developed new nutrient management software (separate from the FLEval model) for land application of manure and chemical fertilizer.

6) Recommendation 38: It is probably most important to update the Feedlot Inventory Guidebook to be compatible with existing data sources and data management methods, electronic feedlot permit forms that are currently being developed and the feedlot inventory database developed for the GEIS.

7) Recommendation 40: The definition, or source, of the "historic contribution ratio" is not clear. The intent regarding an ability-to-pay eligibility criterion is not clear. Both state and federal cost-share for feedlots already utilize funding criteria that address environmental benefits (e.g. FLEval rating, riparian location, local water plan priorities and environmental priority areas).

Land Use

1) BWSR comment number 1 for the "Role of Government" chapter and associated recommendations also applies to this chapter and recommendations, because good and timely information is key to effective early coordination that helps avoid land use conflicts. This and other chapters identify the need for good science, as well as land use decisions based on facts and findings, as key to more effective land use planning and feedlot regulation. Good GIS data layers can be great assets to achieve good land use decisions.

Soils and Manure

1) This is the only chapter that does not have a corresponding heading in the list of CAC Consensus Policy Recommendations. Because some of the water quality recommendations also relate to soils and manure, it might be appropriate to modify the

water quality heading in the list of recommendations to read "Water Quality, Soils and Manure Policy Recommendations Section".

2) Page 145, last paragraph: Are you certain that the statement "With liquid or semi-liquid sources (especially if nutrient concentrations are low) the transportation costs become prohibitive at distances greater than about one mile." is accurate for all types of liquid manure application methods?

3) It would be good to include information about critical implementation issues and payback potential related to good nutrient management.

If you have questions about these comments, please contact Al Kean at 651-297-2907 or al.kean@bwsr.state.mn.us.

Ronald D. Hamack
Executive Director

cc: Senior Management Team
Board Conservationists
Wayne Zellmer, Grants Coordinator
LeAnn Buck, Executive Director, MASWCD

AIR QUALITY COMMENTS:
Lowell Schafer, Goodhue MN

After reading the 12 air quality recommendations, I was drawn to the main theme of most of these recommendations. They used the words Encourage, Applicable, Appropriate, Reform, Respond, Develop, Objective, Facilitate, Support, Conduct, and Maintain.

These are not the words that rules are written from. It is not my goal to be critical of the CAC Committee. They only found what is the underlying problem with this issue.

You can not manage what you can not measure. Needless to say, you can not enforce what you can not measure. Until we have the science to accurately and economically measure whether complaints have merit or if any health threats are real, the whole process will be nothing but unlimited confusion, frustration, and litigation.

The final draft of the GEIS to our lawmakers should only urge that funds be appropriated for developing the needed technology. Only then can enforceable standards be set for air quality.

Senator Dayton hears Feedlot Concerns

Pope Counties Mothers and Others Concerned for Health, Inc. Hosts Meeting in Villard

Invited guests flew into the Glenwood Airport from across the State recently to discuss local feedlot issues with Senator Mark Dayton. The August 17th informational meeting was hosted at Dayton's request by Pope County Mothers and Others Concerned for Health, Inc. The meeting was held at the Allen and Ivie Cooley residence in Villard.

Dayton, as a member of the U.S. Senate Committee for Agriculture, specifically wanted to know what impact local feedlots were having on the health of individuals and communities, as well as on neighboring farms, lakes, and local businesses. Representatives from Clean Water Action and county and township officials heard Dayton's promise regarding the problems faced in enforcing local ordinances, “I will make it one of my most important challenges."

Farmers, businessmen and citizens shared their concerns with Senator Dayton on affects to their health and environment caused by unregulated feedlots in Minnesota. The consistent theme was the lack of enforcement of existing statutes, ordinances and laws by local and state governmental agencies.

Pope County citizens worked long hours to develop a comprehensive Land Use Ordinance, and unless it is properly administered, we face the threat of continued pollution of our air and water. Our organization believes that we must make a difference in securing compliance to existing laws.

Organization Refreshed

The founders of PCMOCH have worked diligently over the past several years to seek compliance with the laws governing pollution control. We have decided that we can be more effective if we organized Pope County Mothers and Others, Inc. as a nonprofit corporation to serve as a positive resource for the community to promote healthful environment through protection and preservation of clean air, water and soil for this and future generations. We will be holding meetings throughout Pope County in the coming months to discuss concerns and address the development of strategy for key issues. We look forward, with your support, to leading educational, scientific, and legislative activities in connection with environmental issues in Pope County. We ask you to join this newly constituted group.

To: Citizens of Minnesota 8/3/01

I am Galen Lisell, a small farmer and a building contractor from Northwestern Minnesota at Roseau, located ten miles from the Canadian border. We are like a lot of farmers and have relied on outside income and long hours to keep the farm viable. I am the third generation to own this farm and this home. I mostly enjoy where I'm at and have planned to stay here.

A few years ago a large hog confinement operation proposed moving in next to us. There was concern about problems we had read about, but were reassured that latest technology had solved these problems and we wouldn't even know it is out there. Also, Pollution Control was there to make sure the public was protected. We were told jobs would be created. Grain grown locally would be fed to the hogs, then the hog manure would produce nutrients for crops and everyone would be a winner.

The community was excited about modern farming to be coming to Northern Minnesota. The project was approved and construction began. Being in the construction business I was interested in making sure that the pit was tight as to not allow manure to get into the water supply. I discovered large holes in the walls in pours because the construction was done in the winter in very cold-temperatures. The pits was built 190 feet diameter instead of the 90 foot proposed. The engineer was not a licensed engineer. The pit was designed so the manure went into the drain tile on the perimeter of the pit and then into the field ditch.

After many calls about the problems to Minnesota Pollution Control Agency (MPCA) they came and had the owners empty the pit to check the wails. The owners were fined and they had to hire Engineers to sign off that everything is acceptable. The intense odors started, sometimes so strong it caused me to have headaches, vomiting, and just completely overwhelms your being. The worst odors occur in the late evening and are strong enough to be awakened from sleep.

The following is a synopsis of my experience since 1996:

What went wrong, why would MPCA allow this to happen? The owner visits and says he is doing a number of things to prevent the odors but nothing gets better. MPCA says how little they an do and are not responsive. I can't seem to convince people how bad it can get and many do not believe it. Even with complaints to the township board, they are reluctant to pursue issue with the owner for fear of being sued by someone with more money that the township funds. The county was also asked to review the issues and the police investigated. The county attorney refused to prosecute. The question is what is to much and how to prove the odors. Now the question becomes, can we stay here to live or should we leave?

Depression starts to set in because of the injustice in the situation. About this time I read about a Citizens Advisory Committee (CAC) committee being set up to find some answers to problems I had been experiencing.

I applied to be a committee member, not that I wanted too, but that I had to. I received a denial and found a list of people selected. After reading the qualifications, I felt relieved I wasn't selected because of all the qualifications the selected members had. I hoped, at least they knew how bad the situations get living next to feedlots. A short time later, I received a call asking if I would serve on the CAC. Now, the question became, should I or is there someone better qualified? I know there were many, but do they get impacted like this? I decided to give it a try

The first meeting, I remember hardly able to say anything wondering if I could contribute and make a difference. I did not have the credentials of the other members or the ability to speak and write as they did. I went home wondering if I'd done the right thing to only to get hit again by the intense odor. Anger, dark thoughts, and a feeling of hopelessness overcame me. I could not get motivated to do repairs to our farm or to make improvements. Others acceptance of the odors and nothing being done caused me to be angry and frustrated.

Where Is the limit to what Is acceptable? When neighbors find an operation unacceptable and are severely affected why are corrective actions not taken? When health standards, for example, hydrogen sulfide levels are exceeded. Why are exemptions from standards given to producers who produce our food? Shouldn't farmers be held to higher standards? Standards need to be set where the impact to neighbors becomes minimal. Operations need to be designed with the standard to be attainable. Why are those that do not meet the standards allowed to operate? Why are the lending institutions not making sure environmental standards and quality of life are not impacted for fear of shutting down.

It's a basic understanding that in life nearly everyone wants ownership of property and to be ones own boss. If the ownership stays in the rural communities than the profits may also stay the rural area. Large operations gives fewer and fewer people that opportunity. With the troubles of air pollution, neighborhood issues, and the surplus of food, does our society need to continue to go down the road of bigger and bigger farms? We can't compare large feedlot operations to small-diversified farms because feed prices are below cost of the production. The low feed prices and production continues only due to the government support. If support were taken away, supply would tighten and the prices of grains would rise. The smaller diversified farm operation would be much more competitive and viable.

My View of the CAC on the GEIS:

Commodity group seemed unwilling to look at most environmental problems or health concerns and are very resistant to looking at animal welfare issues. I see them as minimizing problems instead of finding solutions to issues. They have the legislators ear and are very active politically. They pursue Legislature exemptions to problems rather than correcting problems.

The Minnesota Agriculture Department appears interested in agriculture getting bigger and bigger to survive. It needs to be focused on where society wants agriculture to be.

MPCA seems unable to find, address, or correct problems in agriculture. This may also be political.

The University of Minnesota studies seems to go where the money is for grants. Are they more directed by money sources than the Issues Is the attitude, they can't bite the hand that feeds it. They need to stay objective to be credible. The money allocated to the University of Minnesota by taxpayers should be dealing with the consumers, society, and communities as the top priority.

With fewer and fewer rural legislator, few legislators have the knowledge of agriculture issues. Therefore, they rely on the advice of few. Unless farm commodity lobbying groups can be countered successfully at the legislature feed lot neighbor concern will not be addressed.

If expansion of animal agriculture is to be a part of the future of Minnesota. Animal Agriculture must prove to be a good neighbor. Proposing to the legislators for exemptions from odor issues and lawsuits is counterproductive. The odor levels are not acceptable. How to convince others of this is hard to do, some don't want to listen, as it doesn't affect them. You cannot video tape the situation, there is no set time of occurrences of odor, and it occurs mostly after working hours in the evening and the nights are the worst.

Where is the government protection of basic rights of the citizens? How is this odor issue any different that the requirement of the non-smoking policy of our government and public buildings?

From: Ed Langerak
To: <eqb®mnplan.state.mn.us>
Date: 9/13/01 2:37PM
Subject: GEIS comments

To George Johnson
From Edward Langerak,
St Olaf College,
Northfield, MN 55057
(507 646-3493)

Re: the GEIS on animal agriculture

I have just a few comments on the draft:

1. I appreciate and support the use of a phosphorus index for nutrient application.

2. I would like more attention paid to the cumulative effects of various types of animal raising.

3. I think the draft does not attend enough to alternative systems of animal agriculture, such as rotational grazing.

4. The reference to "judicious use" of sub-therapeutic antibiotics is, I fear, much too weak, since some people see extensive use as judicious. It should refer to "rare" or "exceptional" use, or else we simply breed stronger bacteria.

Thank you for your attention.

MINNESOTA CROP PRODUCTION RETAILERS

September 14, 2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

RE: Comments on Generic Environmental Impact Statement on Animal Agriculture.

The following comments are being submitted on behalf of the MN Crop Production Retailers (MCPR) Legislative Committee. The MCPR is a statewide organization representing firms and individuals providing crop production inputs (seed, fertilizer and ag chemicals) to farmers. In addition, a major portion of our members are Certified Crop Advisers (CCA) a national certification program administered by the American Society of Agronomy.

Here are our specific comments on the recommendations contained on pages 18-26 of the draft document dated August 10, 2001.

#10 – The statement "Nitrate is the most common contaminant in Minnesota's groundwater" is of concern. Nitrates are reported the most by the Dept. of Health when reviewing water quality because of the blue baby syndrome. Does this mean it is the most common contaminant?

Nitrates are natural occurring and come from a wide variety of sources including: legumes, municipal waste, breakdown of organic matter and rainfall. Manure and commercial fertilizers are not the only sources of nitrates. To restrict or regulate only these two sources may not make a difference in the amount of nitrates in water.

Best management practices are defined as voluntary practices. To require BMPs would be a contradiction. This recommendation taken literally would mean that BMPs for manure and commercial fertilizer would become restrictions.

Suggest changing the wording to promoting BMPs for manure and commercial fertilizer in areas where nitrate levels in groundwater are approaching levels of health concern (10 PPM).

#24 - Wording states cost sharing would be for "complying" with P index and N management. This would indicate the group is recommending to require the P index and N management - whatever this is.

We would oppose requiring the P index because it is just now being developed and it remains to be seen if it will work. Also, we would oppose N management without knowing what is being recommended in this area.

The recommendations relate to programs administered by BWSR, MDA, USDA and MPCA. These programs may be administered by these agencies, but they do not have the staff or the money to implement them. In Minnesota there are over 800 Certified Crop Advisers located throughout the state who could implement these programs without the addition of more staff at the agency level.

Suggest adding wording to allow cost sharing for implementation of nutrient management practices coordinated through Certified Crop Advisers or other approved third party groups.

Also, suggest wording to make costs of trying the P index or N management eligible for cost sharing. Do not require these practices now.

#25 - Again, this recommendation requires the use or adoption of the P index. We need to walk before we run. The P index being developed by the University of Minnesota researchers is being looked as a guidance or risk management tool - not as a regulation. There are too many variables in crop production to require the P index without knowing how it will affect the profitability of farmers.

Suggest to drop the word require from the recommendation.

#30 - This recommendation calls for more health-based standards for "suspect chemicals". What are suspect chemicals? Why are they suspect chemicals?

This recommendation is too vague. Today's technology can detect anything you want to find. Just because you have a detection does this mean the compound or chemical is bad or a contaminate.

Suggest to change wording to address those compounds known to cause health problems - not everything under the sun.

#32-To require the implementation of BMPs for all land applications of commercial fertilizer is not needed.

For your reference, commercial fertilizer is blended to meet the needs of the soil and cropping conditions of the farmer. The final blend could include one, two or all three of the major nutrients (N, P & K). When applying manure, there is no option to exclude any of the major nutrients - all three are included at some level. To require the implementation of BMPs for the land application of commercial fertilizer with only one nutrient - say K - would be unnecessary.

Suggest deleting the reference to commercial fertilizer from this recommendation. There already exist BMPs for nitrogen fertilizer which have been developed by time University of Minnesota.

#36 - What is FLEVAL?

We question if BWSR Is the agency or body to do this assessment. Do they have the capability to do this research and is it not already being done by another agency or the University of Minnesota.

Suggest dropping this recommendation. There are other recommendations which address this same subject.

#37 -The recommendation calls for research on losses through tile lines.

There has been a lot of research already conducted on the subject of nutrients.

Suggest dropping the 'nutrient" reference. It is and has been done.

#41- This recommendation references TMDLs.

TMDLs is a federal program and it is under a lot of scrutiny today. One of the problems with implementing TMDLs is the cost. Recent estimates are, it would cost $900 million to implement TMDLs. This is a very costly program.

Suggest dropping any reference to TMDLs To proceed without having the program first authorized by the federal government could be costly to state agencies as well as farmers and agribusiness in the state.

#43 - As we understand this recommendation, it is trying to push forward the concept of watershed based management.

We have serious concerns with this type of regulatory scheme. These concerns are based on University of Minnesota information which indicates water bodies like the Minnesota River would be better served if the land along it would be divided by Agroecoregions. These regions would be set up based on similarities like soil types, cropping systems and land slopes.

Watershed based management does not take into account these features. To impose BMPs or restrictions on the entire watershed does not make sense when they would be better applied to a specific agroecoregion instead.

Suggest allowing watersheds to be broken up into agroecoregions and then looking at management practices in these areas. Watershed studies should not be used alone.

#58 - Again, this recommendation supports the watershed based management approach. We do not support this.

The local water planning process has been in place for some time. It appears to be working in most areas of the state. In addition to water plans, there are several other programs like well-head protection which are now being required.

Suggest the coordination of all local water related programs - not just water plans. Include; well sealing, well drilling, wet lands, CRP, CREP, well-head protection - to name a few.

#63 - Calls for support of small-sized producer programs.

Suggest dropping this recommendation or expand it to include all producers. Are small-sized producers better or why are they being singled out?

Closing Comments

Having reviewed these recommendations, it appears the CAC would like to regulation the use or application of commercial fertilizer. There is not a specific recommendation that states this, but several contain references to application rates.

The commercial fertilizer industry takes pride in providing the "right" recommendations to farmers on what products to apply and in what amounts. Our basis for making this statement are:

1. The industry actively promotes and publicizes (through the media) the BMPS for fall applied nitrogen fertilizer (not until soil temp reaches 50 degrees or below).

2. The industry supports and employs individuals who have become Certified Crop Advisers (CCA). There are over 800 CCAs in Minnesota. This national program sets the bar for knowledge in the area of crop production and requires continuing education credits - 40 every two years.

3. The industry works with University of Minnesota researchers and extension staff to deliver the "right" agronomic information to farmers.

4. The industry has taken the first step and developed a "memorandum of understanding" with the NRCS to provide nutrient management plans to farmers.

As you can see, we take our role in crop production seriously and have committed time and money to making it work better. Last but not least, we would like to leave you with this thought:

‘Commercial fertilizer is an expense to the farmer when growing a crop. To use more than what is actually needed, only increases the cost to the farmer and lowers his profit. On the other hand, manure has been considered by many as a waste which needs to be disposed of.’

Thank you for the opportunity to provide these comments. If you need additional information or have any questions, please contact us.

Craig Sallstrom
Executive Director

Comments Listed by Specific Recommendation

Elden Lamprecht, D V.M.

Human Health Policy Recommendations

#11 The GEIS recommendation contains the component features of an effective human health protection policy. It just doesn't give credit to the industries and market forces responsible for their effective implementation. All of our state's commercial meat processing plants are currently operating under ISO-9000 type approaches in food safety and quality assurance, that provide product traceability. High technology animal identification and traceability, as it applies to identifying the source of animals, is being implemented voluntarily by producers where market forces have established that a higher value food products exist because of such technology. The traceability feature does not necessarily equate to higher quality in food products.

Animal Welfare policy Recommendations

#65 Humane codes of practice for animals should neither be established nor subsequently legislated. The biomedical laboratory animal research industry has just gone full circle on standards for laboratory animal housing and care. The industry has abandoned the initial set of engineering codes and replaced them with performance standards ("Guide for the Care and Use of Laboratory Animals" National Research Council, 1996). Laboratory animal research has proven that the code standards inferred by human intuition had little to no value to the well-being of animals. Farm animals used in research have their own animal welfare guidelines (USDA APHIS Animal Welfare; Farm Animals Used for Nonagricultural Purposes, Fed. Reg. 65[23] Feb. 3, 2000). As appropriate, this guide is intended only as a guide. It represents the most current thinking on appropriate practices for the handling, care, treatment, and transportation of farm animals used for nonagricultural purposes. The guide contents are widely practiced by common sense on modem livestock farms. They are common knowledge.

#67 & 68 Voluntary and mandatory certifications are an intuitive response when a perceived or real animal welfare offense, committed by the minority, is observed by the public. In an analogous situation, <0.08% of the 14,000+ private flights to Oskosh Wisconsin's "Air Adventure" air show ended in fatal crashes. The hue and cry went out by those desiring to kill off general aviation to add more restrictions to a sport already replete with mandatory and voluntary certifications. General aviation's ongoing solution is two pronged; 1) work with youth in developing respect and appreciation for the sport, and 2) use peer feedback to advise colleagues with poor piloting skills that they are putting lives of people at risk. Organizations like the Minnesota Foundation for Responsible Animal Care are developing and providing programs for young and old inculcating the principles and practices of humane animal care.

The SE MN Ag Alliance was asked to comment on the CAC Recommendations. W e have done so.

I am responding specifically to the HUMAN HEALTH POLICY RECOMMENDATIONS section. Our response is generated not only from the perspective that livestock farmers rely upon the production of livestock for their livelihoods. but also from the perspective that they personally, and those close to them, are subject, more than most, to the health risks associated with farming.

Above all things, farmers are concerned most with the health risks to which they expose themselves, their families and employees. All endeavors, however, carry certain risks, and farmers, as does everyone else, balance the potential for harm with the need to complete a days work.

Concerning the Human Health Policy Recommendations, the SE MN Ag Alliance is asking for a balanced and weighed approach to identifying and regulating health risks. We would hope that efforts to regulate animal production in an attempt to control health risks would first and foremost be based on sound scientific research and information. Secondly, we would hope that a cost/benefit analysis be completed when new regulations are proposed to determine if the incremental "protection" is worth the price.

We have identified a lot of common ground within the CAC Recommendations. We do have areas of concern.

(Please see specific responses)

CAC Consensus Policy Recommendations

The Animal Agriculture Generic Environmental Impact Statement (GEIS) deals with a wide range of complex and interlocking social, economic and environmental issues. In addition to collecting and analyzing detailed technical information, the GEIS tried to identify priorities and develop policy recommendations to the Minnesota Legislature and EQB.

Over the course of three years CAC discussed the topics areas in great depth. Each CAC member spent several hundred hours of time in meetings on this project plus hundreds of hours of personal time reviewing , commenting and reading documents and background information. Our best estimate is that each CAC contributed at least a thousand hours of time to this project possibly much more, in many cases. 'When you multiply this individual effort by the number of CAC members and their alternates. have donated many thousands hours of time to this project.

CAC self imposed requirement for unanimous consensus on any policy recommendation passed. This was designed to prevent any majority or minority faction of the CAC from being able to control future policy direction. A large number of policies were discussed by CAC but could not achieve unanimous agreement, so these do not appear in the document. The seventy-one policy recommendations appearing in this section were agreed to by every CAC member.

Every CAC member had to agree to support the policy or it did not appear. This limitation minimized personal biases in this section of the Draft GEIS. The Citizens Advisory Committee has labored diligently for more than three years to ensure that every major point of view was considered. This document will not answer all questions or solve all problems. There are many serious questions which will require further research and policy discussion efforts to resolve. Some questions asked were too complex to study in depth with the time, money and information available.

Consensus Policy Recommendations --- Human Health Policy Recommendations Section

1. Make a greater effort to inform the public about the public health implications associated with disease occurrence, disease transmission, and antibiotic resistance from animal agriculture. Information about steps being taken to protect public health by farmers, processors, industry groups, government, as well as research by academic institutions, industry organizations and government, should be better publicized.

2. Support a comprehensive national program to promote the judicious use of antibiotics for both human health and animal health. The priority use of new classes of antibiotics should be limited to human use. The sub-therapeutic use of antibiotics as a growth promoter in animal agriculture should be reviewed and phase-out considered where science has provided adequate supporting research.

3. We recommend that the federal government publicize and enforce the existing ban on the use of ruminant carcasses and offal in animal feeds to minimize the BSE transmission threat in the US.

4. We support research to characterize health effects, quantify source strength, and determine the environmental fate of outputs of animal agriculture that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research.

5. National systems need to be developed and implemented to track antibiotic resistance in animal agriculture outputs and other diseases that can be passed between animal and humans, including surveillance of such diseases in farm and food industry workers.

6. Accelerate the MN Dept of Health efforts to set health-based standards for chemicals.

7. Human health concerns exist without regard to the size of a feedlot operation or species of animal being raised. Therefore, all feedlots and food animal operations need to comply with the regulatory programs that protect human health. State Financial resources

will be necessary both for the permitting/enforcement agencies and for the implementation of appropriate safeguards by farmers.

8. If a complaint investigation validates the probable exceedance of health standards by emissions or discharges to the environment, the operator must show compliance through continuous monitoring or mitigation.

9. Encourage worker safety plans for feedlots.

10. Nitrate is the most common contaminant in Minnesota's groundwater. Best management practices should be required for land applications of manure and commercial fertilizer to protect all drinking water supplies.

11. Encourage development and implementation of ISO-9000 type approaches in food safety and quality assurance, which provide product traceability, higher value and higher quality in food products. This will allow producers and feed providers to identify the source of animals and animal feed in the event of an outbreak of disease.

Air Quality and Odor Policy Recommendations Section

12. Encourage the utilization, continuous improvement and field validation of all applicable air emission and air dispersion models as accepted by EPA and/or PCA to develop tools to deal with air pollution control.

13. Encourage the utilization, continuous improvement and field validation of applicable computer programs and models, such as OFFSET, which can aid in predicting appropriate operational practices, setback distances and odor levels.

Human Health Policy Recommendations:

I. We cautiously accept the first part of this recommendation, with the stipulation that only information from actual scientific studies be released to the public. Speculation and hearsay are not justification for a press release. Releasing large quantities of information, before all of the facts are in, only serves to frighten the public. We do agree that it would be beneficial to publicize the steps being taken to protect the public's health.

2. We do not support this recommendation as it is written. It is required that all businesses, including Agriculture, follow all USDA, and FDA rules and regulations, states do not have an option as to whether or not they follow Federal guidelines - they are mandatory. National agencies, such as USDA and FDA should and do have the final say, based on legitimate scientific studies, to regulate which drugs are appropriate for animals

and which should only be used for animals. We feel it is unethical for states to make individual assessments on drugs - it needs to be a uniform National policy.

3. This is already law.

4. We feel the wording of this recommendation is very confusing. All business enterprises, Agricultural or not, carry varying degrees of health risk. As long as Agriculture is not singled out, or subjected to rules and regulations that are not required of other business, and these health concerns are based on factual evidence, we support the identification and elimination of health risks.

5. Minnesota is currently compliant with all National guidelines. Again, the States cannot mandate National programs.

6. This is a very vague statement. We are not sure which health based standards for chemicals are currently being reviewed. Is the review being done because of improved monitoring systems, or are there chemicals that currently do not have the health risks documented?

7. As long as Agricultural enterprises are treated consistently with all other businesses in tire State in terms of their pollution potential, and the economic integrity of the individual farms is guaranteed - we would agree with this recommendation. We do feel the term "State financial resources" should be more clearly defined.

8. This is a valid recommendation as long as a time limit imposed. Once a problem has been corrected - a uniform time period for continued monitoring should be in place and adhered to. There must also be a Statewide measuring standard to insure consistency. It is also our concern as to who pays the cost of this monitoring. With monitors costing upwards of $10,000 - the cost is prohibitive for individual producers.

9. We would support this if it is discretionary and not mandatory. Rules and laws already legislate employee safety in the workplace and to arbitrarily target feedlots for additional mandatory safety regulations, without factual supporting evidence that this is necessary, is redundant.

10. Agreed

11. Although ISO-9000 does assure traceability, it does not assure higher quality in food products. Food safety is of paramount important to producers and processors alike, but simply tracing the out break to the infected source eliminates only the short term immediate problem. This issue needs to address the problems before an outbreak occurs, not to simply locate the source.

Submitted by Stan Estes

When a hen starts setting on eggs for the first time she is so concerned about the safety of her eggs that she does not leave the nest to relieve herself. As a result her manure gets on the eggs and though she is well intentioned, the manure contaminates the eggs and she kills her young.

This GEIS document may be will intentioned but unfortunately it does nothing to keep us from contaminating and killing our young. When you go to a sustainable ag farm tour everybody walks the fields, pets the cats, cows and sometimes the chickens. If you tour a confinement facility you have to be dressed in biosecure clothing which is disposed of when you leave.

In his book, Superpigs and Wondercom, Dr. Michael W. Fox states that the genetically engineered pigs will have to be raised in a secure environment because their immune systems are unstable. If you have noticed the pharmaceutical ads on television lately, there are asthma and allergy medications for children as young as two. These illnesses are symptoms an overburdened immune system. How has that happened? Is the food that we are feeding to these young, innocent, trusting people killing them? Are we like the inexperienced hen, well intentioned but still killing our children?

I know families that raise their children on chemical-free foods. These children are bright-eyed, beautiful and brilliant. As you place the food before your children tonight, ask yourselves, "How was this food raised, where did it come from." Will this food they are eating nourish them or further damage their immune system and shorten their lives.

Minnesota Planning
Written comments on: Animal Agriculture GEIS

These written comments are submitted to supplement the comments that I made at the Public Meeting on the Draft GEIS on Animal Agriculture in Rochester on September 4, 2001. My focus for these comments is recommendations numbers 1 and 2 in the Human Health Policy Recommendations Section of the Consensus Policy Recommendations (page 18),

My background is that of a 24-year resident of the city of Rochester. I am a physician trained in both Pediatrics and in Radiology. I practice Pediatric Radiology in both inpatient and outpatient settings. I have published over thirty medical papers and more than 10 book chapters including one dealing with diarrheal diseases in children.

Since the September 4th meeting in Rochester, I have read the recently published book *Hogging It*! Estimates of Antimicrobial Abuse in Livestock by Mellon, M, Benbrook, C, and Benbrook, KL, UCS Publishers, Cambridge, MA, 2001. These authors, with the advise of many experts and the best available literature, have worked out new estimates of the amount of antibiotics used in animal agriculture in subtherapeutic doses (these authors use the term "nontherapeutic" to include both growth promotion and disease prevention). As opposed to the frequently quoted figures of 35-50 of antibiotics being used for subtherapeutic (nontherapeutic) uses, these authors using well-defined and appropriate methodology, demonstrate that actual total animal agriculture antibiotic usage is 84% and that subtherapeutic (nontherapeutic) usage is 70% of total antibiotics produced in the United States.

These data urgently underscore the problem of antibiotic use in animal agriculture. In this book and in the Draft GEIS on Animal Agriculture (p.160), a number of recent articles are cited that show that animal pathogens that are antibiotic resistant have been transmitted to humans. Working in hospital settings for over 30 years, it has been my experience to witness the ongoing emergence of resistant bacteria to an increasing number of antibiotics. Although new antibiotics and new classes have been developed, this process is slow, and we are falling behind.

"The problem with both disease prevention and growth promotion usage is the pattern of use: exposure of microorganisms to selective pressure over an extended period. This pattern is the optimal recipe for
creating large populations of resistant bacteria. By contrast, the pattern of use for properly administered therapeutic drugs-shot times and high doses - is far less likely to trigger resistance" (from Hogging It, pages 21-22 with reference to National Research Council (NRC). 1999. The Use of Drugs in Food Animals: Benefits and Risks. Washington, D.C.: National Academy Press).

The pressure of the huge amount of antibiotics used in subtherapeutic (nontherapeutic) animal agriculture is a problem with which we must deal. The European Union has banned the use of subtherapeutic antibiotics in animal agriculture. Confinement animal agriculture facilities in Europe are kept scrupulously sanitized so that herd treatment with antibiotics is not practiced for disease prevention.

It has been demonstrated in Europe that the abandonment of subtherapeutic antibiotics in animal agriculture does not lead to increased infection rates in livestock or to economic hardships for producers. Such positive animal health and financial consequences are accompanied by the additional positive potential for decreased development of resistant bacteria passing from livestock to human populations. This is a loud call to action.

Specifically, in recommendation 2, the phrase, "to promote judicious use of antibiotics for both human and animal health" should be considerably strengthened. This document should strongly recommend eliminating subtherapeutic antibiotics in animal agriculture for growth promotion and for disease prevention. Ultimately, the decision to ban this usage may be determined nationally, by law or by FDA regulations, but it is still appropriate for this GEIS on Animal Agriculture to make such a strong recommendation on this critical issue.

Alan Hoffman, MD 2223 Viking Dr. NW Rochester, MN 55901-3534

George Johnson
MN Environmental Quality Board
658 Cedar St
St. Paul, MN 55155

Re: GEIS comment for CAC

Dear Mr. Johnson:

We farm south of Northfield in Rice County. When I put up a new confinement building for a 50-sow operation, I had hopes of increasing my income substantially and had two sons to help. I used a combination of indoor and outdoor, which I still favor. Manure from the pit went on my own fields.

Large confinement systems of today are something else again--many built without thought for neighbors or the environment. Small operators, unable to get financing for improvements to existing operations, are talked into putting up new buildings under contract arrangements. Some are ashamed to talk about it.

A major goal of the GEIS in the Scoping Document was to identify alternative paths with an emphasis on sustainability. According to page 10 of the summary, the CAC "agreed that no consensus could be reached on identification of specific alternative paths for animal agriculture..." and "no consensus has been achieved on the path(s) that Minnesota should strive for"....

So the GEIS is a flop, as one might have expected when a moratorium (cap at 750 au) was not imposed along with it. To say that the Timber Industry GEIS was a success is false--it failed largely because it also had no moratorium on cutting in place and industry people dominated the stakeholder advisory committee. A minority report indicated the problems with it.

To say that the EQB is a neutral agency (p.3) to handle the GEIS with Commissioner of Agriculture Hugoson as chair is also a ridiculous statement. We were not surprised to hear that some of the same legislators who browbeat MPCA during feedlot rule revision efforts also attempted to intimidate staff working with the GEIS.

Nevertheless, there are points worth noting in each section:

Human Health

#2-"Judicious use" is too weak. Restrict antibiotics to therapeutic use.

#3-enforce the ban on ruminant carcasses in animal feed (BSE).

Note: Food Safety Division/USDA is concerned about nerve fibers/spinal cords getting into ground meats. Please add this recommendation to slow down and increase inspection on food processing lines.

10-Yes, but manure application must also consider phosphorus.

Air Quality

#14 Yes--better odor complaint process needed.

#16 Statewide emission inventory sounds like a good thing.

#22 There should be no open liquid manure storage. Dairy should figure in the cost of above ground tanks.

Water Quality

#25-the Phosphorus Index is a good idea, depending on figures used (EPA's or ?)

#27- and #31 are conflicting

#33-Be sure data includes BOD readings (see Wyatt's report attached)

#35-Public tax dollars should not be used for environmental. upgrades of feedlots over 500 au

#42-Animal density limits should be set for regions and watersheds. No mega lots in karst/ sinkhole areas.

Land Use

Siting of large feedlots in karst or karst/sinkhole areas is not addressed as it should be. Note: Normal ag operations do not ordinarily cause "nuisance" conditions (d under #48). This item is insulting.

Role of Government

#50-focus on 2 - 3 priorities is a good idea

#57-periodic inspections should be done.

Social/Community

The CAC did not undertake comparisons of alternative systems (#59, #60) so has failed in its work.

#62-Yes-support assistance to small and mid-size producers

#64-Community impacts of packing plants should be studied

Another property values study should be done--the one discussed by Sen. Dille was a sham.

Animal Welfare --- Strengthen wording:

#65-Mandate humane codes of practice (needs to be in law).

#67-Develop certification programs (leave out “voluntary").

#68-The state should require farmer and farm worker certification.

It is embarrassing that other recommendations of the original 18 were left out, such as #3 - Every animal shall be accorded a painless and distress-free death.

Economics

#72 There Is info out there already, such as Farm Business Management Educ. Program in 1999 reporting that a dairy of 50-70 cows is more efficient than larger ones (see COACT comment).

#76 Cost/benefit analyses are not addressed YET??

These are my comments, BOD comparisons in the Wyatt article, Pollution Potential of Livestock Manure should be included in the GEIS (included by fax)

David Kamis
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507-645-7086
Rural Insights by Gary Wyatt, Extension Educator (Attached article)

Pollution Potential of Livestock Manure

Many livestock producers and consultants do not understand why the public is concerned about land application of livestock manure and the construction of waste storages. As a result they often feel that the government or the community is just trying to make it difficult for them to make a living. However. many people do not understand the pollution strength of livestock wastes compared to municipal sewage.

John Chastain,, Extension Ag Engineer, says that effluent from waste storages, runoff from outside lots or cropland, and milking center wastewater are strong pollutants that can be harmful to fish and other aquatic life. When the organic matter in the manure is decomposed, or oxidized, by microorganisms in a stream or lake, the oxygen level decreases and fish suffocate. The pollution strength of the organic matter in wastewater is expressed as the biochemical oxygen demand (BOD^5) a comparison of the BOD^5 values for livestock wastes and municipal wastes is provided in Table 1. The data indicate that the pollution strength of raw manure is 160 times greater than raw municipal sewage. Diluted manure such as runoff from outside lots is much lower and has a pollution strength that is two to four times greater than raw municipal sewage.

Livestock waste is also high in ammonia and is lethal to aquatic organisms at low concentrations. During the summer months, the ammonia concentration of treated municipal effluent must not exceed 1.5 mg/l and raw municipal sewage has an ammonia concentration of about 50 mg/l. The data in Table 1 indicate that raw livestock waste can have ammonia concentration that are 200 times greater than raw sewage.

The BOD_5 values and ammonia concentrations shown in Table 1 clearly indicate that manure and municipal wastewater must never be intentionally discharged to surface water. In addition, every precaution should be taken to prevent accidental discharges.

Table 1. Comparison of the Pollution Strength of Livestock and Municipal Waste (Source, Understanding the Pollution Potential of Livestock Waste. Illinois Environmental Protection Agency, 1991)

Type of Waste	**BOD^5 (mg/l)**	**Ammonia NH4N (mg/l)**
Undiluted Livestock Waste	40,000	10,000
Manure Lagoon Effluent	14,400	-
Runoff from a Concrete Lot	1,000	-
Runoff from a Dirt Lot	500	-
Raw Municipal Sewage	250	50
Treated Municipal Sewage	30	1.5

The data shown in Table 1 indicate that livestock producers must collect, handle, store, and utilize manure in an environmentally sound manner. Livestock producers and consultants must realize that when they plan an expansion or the construction of a waste storage structure that they are entering into a contract with the public to protect the quality of surface and ground water. Instead of hiding from the questions of the public, we must be ready to explain how we will handle the manure and wastewater generated from livestock facilities in a responsible, environmentally safe manner.

September 6, 2001
Minnesota Planning
GEIS Animal Agriculture Draft Statement

My name is June Varner and my address is 15498-83rd Street, Little Falls, MN. I grew up on a small dairy farm in New York State and most of my work experience was with agri-business companies. I have owned and operated a 400 acre farm in Minnesota since 1978. Until my semi-retirement several years ago, my farming operation consisted of a rotation of small grains with row crops, some hay and a cow-calf operation. I have been active within the community on agricultural issues for about 15 years.

I would have liked enough time to give the draft statement the attention it deserves, and I can readily assert that the short five minute comment time is an insult to the people who spent a lot of their time gathering this information.

The first obvious oversight in this draft is that it lacks specific interim recommendations to protect the public while research and studies are being conducted. There is enough evidence in this comprehensive draft to warrant a ban on certain aspects of confinement livestock operations, and I therefore strongly suggest we follow the Precautionary Principle. I am a MN COACT volunteer and have been active in sustainable and organic agriculture. I am confident that COACT's Agriculture Committee would be willing to outline the most pressing concerns and submit them to the EQB if they were given the time and opportunity.

Another serious omission was the lack of consideration given to the obvious financial and environmental benefits of traditional methods of raising livestock such as pastured dairy, pork and poultry, the cleanliness of hoop barns for pork finishing and the value-added to composting manure.

Human Health Policy Recommendations Section

The Second International Conference on Pharmaceuticals and Endocrine Disrupting Chemicals in Water will be held October 9-11 at the Hyatt on Nicollet Mall in Minneapolis. Many of the concerns under this section are being addressed at this conference and some of the research being presented has been done in Minnesota. Last year the research at this conference was unequivocal - the sub-therapeutic use of antibiotics in livestock must stop. In addition, there are certain medications used in raising concentrated livestock that persist in the manure, and are then taken up by plants and becomes a part of our food stream. The federal ban on carcasses being fed to ruminants does not apply to waste animal fat; a quick reading of the ingredients used in some ruminant supplements only says animal fat, and it does not state which animal the fat comes from. We should also take notice that the prion for BSE is carried in fatty tissues.

Air Quality and Odor Policy Recommendations Section

Odors and dusts contain various compounds that are a real and serious health threat; it is not just a individuals perception. The EPA standard for pesticide drift states that the spray or dust cannot leave the target area. This same standard should be applied to the dusts, odors and gasses from a livestock operation. Modeling does not always fit the circumstances that exist at an actual facility. If a lot of the expertise was focused on site, maybe some of the allegations of pollution that feedlot operations hear could be resolved. In fact, I think that if Agency leaders and their families lived on some of these sites for a couple months, there would be a lot of improvement forthcoming. Compiling data on complaints and filling out forms does nothing to resolve the issue, and placing minimum fines that are paid to State Agencies does even less. If nothing is going to be done to stop drift from the feedlot site, the agencies need to tell the public the truth. Bear in mind that Hydrogen Sulfide is only a measure. Feedlot odor and dusts remain the responsibility of local communities.

Water Quality Policy Recommendations Section

I am encouraged to see stronger concerns about Phosphorus and agree that manure should be part of a total soil nutrient management plan This should be a normal part of every agricultural operation whether it uses manure or not. BMP's need to be established with prevention and education as their focus. This is the only way we can really protect water quality problems from feedlots. EQUIP and other federal or state funding should not be available for operations over 300 animal units. If our state supports independent farm families at all, they will support this limit. When operators get into contract facilities, construction funding often comes from the supplier of the stock and feed; rarely from a local lender.

Land Use Policy Recommendations Section

I strongly support the preservation of agricultural land from random residential development and feel these policies should be part of every Comprehensive Plan. As a Morrison County resident I have attended Land Use hearings where ordinance changes are made to accommodate a single large-scale operator. To avoid checkerboard regulation, there needs to be some clear and specific state standards for land use as it relates to agriculture, while retaining the right of the county, township and municipalities to be more stringent.

Role of Government Policy Recommendations Section

The most important issue covered in this section is that government success depends on a fully informed public. Local and state policies need to respond to everyone's concerns about feedlots not limit their acceptance of complaints to the feedlot neighbors. Feedlots can be inspected every day but the time is wasted if the operation has problems with runoff, dusts and odors and nothing is done to resolve them. Someone should have the authority and responsibility to close a facility.

Social and Community Policy Recommendations Section

This is the most effectively stated section. Several important key phrases are "protects the environment", "acceptable alternatives developed", "increased funding for staff activities", "promoting .. those not engaged in contract production", “identifying … impacts"

Animal Welfare Policy Recommendations Section

The concerns for animal welfare cannot be slighted. My years of experience raising various types of livestock taught me that you can tell when animals are healthy and comfortable. I learned livestock was healthiest when they had a diet of natural chemical-free plants and access to enough area so that natural rearing habits can be followed. The bad news for veterinarians is that I very rarely needed to call one. I did not need any antibiotics, pesticides or chemicals to have strong healthy stock.

Economics Policy Recommendations Section

Economics is the area where "externalities", the true cost of feedlots can be addressed. The flat out truth is that livestock raised in a natural environment is the most economical method. Actual financial records show that the pasture-based dairy system gives the highest net financial return per cow. There can be no better economic persuasion than these records. There is little need to fund large-scale processing plants. There are still many local facilities that could be modestly expanded to accommodate processing of locally raised livestock from independent farmers. These facilities have a history of being the least likely to be a source of fecal contamination. We do not need to attract processing facilities that are not locally owned and operated.

Respectfully submitted

June Varner
15498-83rd Street Little Falls, MN 56345

To: Minnesota Planning, Animal Agriculture GEIS
Re: Public Comments on Draft GEIS on Animal Agriculture
From: Linda Peck, 12299 Sauk River Road, St. Cloud, MN 56301
Date: September 7, 2001

INTRODUCTION:

The GEIS Document over and over recommends additional study and research needs. All require financial and other resources to complete. In general, I agree that more research should be done. However, a caution. Significant resources should also be allocated to other approaches and studies that may direct us away from larger-sized, more concentrated and confined, animal agricultural methods. Two examples of such approaches come to mind:

At the Federal level, the principles contained in the Conservation Security Act

At the State level, the partnership ideas and process under MISA - the Minnesota Institute for Sustainable Agriculture at the University of Minnesota.

HUMAN HEALTH strongly recommend that the sub-therapeutic use of antibiotics as a growth promoter be a) phased out and b) a time frame to do this be established. Sub-therapeutic use of antibiotics is an indicator of animal management failures and a substitute for humane animal stewardship as it allows increased concentration and confinement of farm animals.

Regulatory programs need adequate funding. New feedlot rules will not succeed unless all steps: permitting, inspection, monitoring .... and enforcement receive the resources required. I agree that all-sized animal operators should get help to implement appropriate safeguards. Compliance by all-sized operators is also important BUT non-compliance by larger-sized and more concentrated operators located in environmentally sensitive regions of the state need to be "hit harder" i.e. fines high enough so positive changes result or they are shut down. We need to assure that corporate farms be held liable for their share of losses, public health hazards, environmental damage, etc.

AIR QUALITY AND ODOR It is crucial to get out on-site and field-validate the situation. Computer modeling in an office on a computer screen can not substitute for "air truthing" and testing on-site. If complaints occur, get out of the office and on-site. This is as important as notifying the facility owner that a complaint has been received. Because this is difficult, I strongly support recommendation #15 (p.20) that facilitates and encourages independent standardized third party evaluations and recommendation #21 (p.20) to improve enforcement against long-term non-compliant facilities.

WATER QUALITY In recommendation #23 (p.21) consider adding support for the principles and process in the Conservation Security Act (proposed Federal Legislation) as well as the incentives approach under MAEAP (Michigan Agric. Env. Assurance

Program). On page 114, support research into the potential negative effects of agricultural drainage but do not restrict this just to water quality issues.

Support the development and implementation of alternatives to the land spreading of manure especially when feedlots occur in sensitive geological areas of the state prone to groundwater contamination like Central Minnesota. One example is manure that is managed for energy, these self-contained operations use the manure produced on-site to generate energy for use on-site. Any excess energy may be sold and the digested manure residue can become a garden and lawn soil amendment. Such a digester system is already in operation at Haubenschild Farms near Princeton, MN.

LAND USE Under recommendation #48 (p. 23), sub item e., I prefer purchase of development rights. If transfer of development rights is encouraged, need to have identified appropriate lands to receive the transfer. These lands must fit into local and county land use plans for development.

ROLE OF GOVERNMENT Recommendation #50 asks that two or three clear priorities be identified that the state should focus on. Here are three suggestions:

1) Adequately fund all steps of the new feedlot rules and enforce them.

2) Complete the Economic Analysis - fill in the gaps identified. You state on page 110 that it is important to document and quantify the externalities associated with animal agriculture. The hidden social and environmental costs must be more completely determined in order to make informed decisions about the REAL costs and benefits of animal agriculture. I totally concur. The following are needed:

a) Research completed on the spillover costs (see page 110)

b) Get economic information on "Main Street" issue: how much loss people suffer as traditional rural small-town lifestyles disappear as animal consolidation escalates (see page 110).

c) Does concentration of production make particular externalities worse, better, neither? Is production that is more efficient in a business sense actually less efficient in the economic sense i.e. produces lower total social welfare.

3) On page 75 it states that one of the bottlenecks to the adoption of sustainable methods of agriculture may simply be the lack of technical assistance from the government. If this is so, increase the role that the Minnesota Department of Agriculture's Energy and Sustainable Agriculture Program plays and up the number and amounts of grants available. In like fashion, fund more firmly the efforts provided by the Minnesota Institute for Sustainable Agriculture.

SOCIAL AND COMMUNITY Recommendations #62 and #63 are especially important. Small and mid-sized producers are crucial to the state and rural communities. More funding should be focused in their direction.

ANIMAL WELFARE Either expand and finance the Minnesota Board of Animal Health's mandate to include the health and well-being of individual animals on farms, during transport, at stockyards/slaughter houses OR fill this gap some other way.

Maximizing food production should not be so that the animal is no longer viewed as a living thing but becomes just chops, thighs, breasts and steaks. Animal welfare science must take precedence over the more limited animal production science. American consumers alone should not be the sole entity demanding changes - the government should require them (see p. 185). Meat is cheap in this country. Just compare the cost for 1 pound of meat to 1 pound of potato chips, tortilla chips, and other snack foods for example.

ECONOMICS As mentioned earlier, this chapter is incomplete. The analysis needs to be finished. Crucial is the analysis of spillover costs, "Main Street" costs, and the documentation and quantifying of the externalities. We need to get a better handle on the REAL costs and benefits of animal agriculture. (see page 110).

I especially support the following recommendations: #71, #72, #73 with an addition supporting the Conservation Security Act, #74 and #76. In addition, I highly support point #6 on p. 109 encouraging greater collaboration between economists, sociologists, anthropologists, ecologists, and production agriculture scientists in studying the economic, social and environmental impacts of different types of agriculture.

SOILS AND MANURE On page 154, you state that we should:

Prevent the build up of animal densities to levels so high that adequate land for manure application is not available within reasonable hauling distances
Encourage sound management of manure so that nutrients are efficiently used by crops

Encourage manure-management practices that minimize risks to soil and water quality.

I agree with these policies. In addition, I feel adopting methods of reducing nitrogen (N) and phosphorus (P) in animal manures is worth pursuing but not at the expense of reducing the size and concentration of animals at one farm operation. If a P Index is successfully developed for Minnesota soils, perhaps providing financial incentives to use Phytase in swine feed is appropriate especially in regions of the state where the P soil index is high.
Linda Peck

From: Hartley Clark
To: <George.Johnson@state.mn.us>
Date: 9/10/01 10:29AM
Subject: GEIS Item 2

Recommendation #2 is weak. The words "judicious use" are not strong enough. In addition to the American Medical Association, the Union of Concerned Scientists has called for a ban on the sub-therapeutic use of antibiotics in animal feed. In their recent report, they estimate that 70% of U.S antibiotic production--25 million pounds a year- is used by animal agriculture, versus 3 million pounds for human use. In addition, the Mayo Clinic did a study in 1992; their study should certainly be consulted by the GEIS committee.

The European Union has banned four antibiotics for use by farmers, as recommended by the World Health Organization. Representative Sherrod Brown of Ohio has introduced legislation in Congress to ask that the same ban be enforced in the United States. Several public health groups have petitioned the FDA to stop any use of antibiotics that are currently used in human medicine.

I hope that the GEIS committee will take a progressive stand on this issue.

Barbara Clark

From: "Heather Lane"
To: <George.Johnson@siate.mn.us>
Date: 8/31/01 5:45PM
Subject: GEIS on Animal Agriculture
To Minnesota Planning Board

Re: GEIS on Animal Agriculture

Thank you for instituting humane codes of practice, production methods that foster animal welfare, certification programs that include basic animal welfare standards, and farmer certification. In addition to the recommendations you have already adopted, please also adopt the following recommendations included in the technical working paper on Farm Animal Health and Well-being:

Recommendation 1: "Farm animals are sentient beings and caretakers and animal production systems shall take into account their basic biological and behavioral needs in construction, operation and management."

Recommendation 2: Animals have a right to be free from fear, pain, want, lack of stimulation, and discomfort.

Recommendation 3: Farm animals must be humanely slaughtered.

Recommendation 4: Farm animals have a right to express natural behaviors.

Recommendation 6: Farm animals have a right to humane transport. Downed or disabled livestock should NEVER be marketed.

Recommendation 11: Institute the phase-out of gestation crates and battery cages.

Adopting these recommendations would dramatically improve the lives of farm animals in intensive livestock systems in Minnesota. Farm animals are sentient beings who feel pain and fear just as cats and dogs, and they have a right to basic humane treatment. Adopting the recommendations listed above would dramatically improve farm animal welfare in the state of Minnesota.

I thank you for your time and consideration.

Sincerely,

Heather Lane
Waconia, Minnesota

From: Jan Cummings
Date: 9/7/01 9:34AM

Please work for humane treatment of farm animals. It is extremely important to me that animal rights are protected in this state'

Jan Cummings

From: "JULIE EYRICH"
To: George Johnson
Date: 9/2/01 10:24AM
Subject: GEIS on animal agriculture

To Minnesota Planning Board,

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Thank-you, Julie Eyrich

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I thank you for your time and consideration.

Sincerely,
Kathy E. Hucks.
1100 Farmington Avenue

From: Mark Reed
To: George Johnson
Date: 9/2/01 7:57PM
Subject: GEIS on Animal Agriculture

To the Board:
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We thank you for your time and consideration.

Sincerely,

Mr. and Mrs. Mark H. Reed
1875 Troy Lane
Minneapolis, MN 55447-2549

From: "Missy Stine" amstine@backpack.net>
To: George Johnson
Date: 9/9/01 4:09PM
Subject: comments on farm animal study

I understand that you will be holding a meeting on September 10th at the U of M regarding the study on farm animals conducted by the Minnesota Legislature. I would like to comment on the changes I see are necessary, since I cannot make the meeting, I am writing you instead.

I find it absolutely horrifying that we allow live creatures such as chickens, sows and pigs to be treated in such a cruel manner, as they are in factory farming. Sows are left in gestations crates that they cannot even turn around in. Chicken are in battery cages so small they cannot spread there wings, then the factory farms cut off there beaks to prevent them from pecking other hens, all because they cramp the cramped battery cages into such a small area. On top of all of that they are not provided with adequate food and water, or allowed to lay down on straw. Instead they lay on wire mesh, or cement.

As a caring, tax paying, citizen of the State of Minnesota I want all of those things to be changed. I want us show all the world that we recognize that, despite the fact we raise animals for food, we treat them as living beings who feel pain and stress, and who deserve our respect.

These animals are not things. I want us to create and enforce laws that support that we understand that they are living creatures, not only because we would never treat humans (all living creatures) that way, but because it is the right thing to do.

Thank you Melissa Stine
1921 Laurel Ave W
Minneapolis MN 55405

From: "Michael Lane" <m@mlane.net>
To: George Johnson
Date: 8/31/01 6:32PM
Subject: Re: GEIS on Animal Agriculture

Re: GEIS on Animal Agriculture

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I thank you for your time and consideration.

Sincerely,

Michael Lane

Written comments can be sent until 9/14/2001 to:
MN Planning, Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

fax: 651-296-3698,
Attn. Animal Agriculture GEIS
e-mail: Johnson@mnplan.state.mn.us

From: Tracy Jordan
To: George Johnson
Date: 9/1/01 2:08AM

Re: GEIS on Animal Agriculture

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Sincerely,
Tracy Jordan
1983 Luck Rd.
Galivants Ferry, SC 29544

"All the arguments to prove man's superiority cannot shatter this hard fact: In suffering, the animals are our equals" -Peter Singer

From: Vanessa Marcol
To: George Johnson
Date: 9/1/01 7:25PM

Subject: Re: GEIS on Animal Agriculture

MN Planning, Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155
fax: 651-296-3698

Re: GEIS on Animal Agriculture

I would like to express my gratitude and thank you for instituting humane codes of practice, production methods that foster animal welfare, certification programs that include basic animal welfare standards, and farmer certification. In addition to the recommendations you have already adopted, please also adopt the following recommendations included in the technical working paper on Farm Animal Health and Well-being:

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I thank you for your time and consideration in this sensitive matter.

Sincerely,

Vanessa Marcol
295 York St.
Jersey City, NJ 07302

August 31, 2001

MN Planning,
Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Enid Morhaleck
1278 Ellis Mill Rd
Mullica Hill, NJ 08053

Re: GEIS on Animal Agriculture

Dear Sir or Madam:

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I thank you for your time and consideration.

Sincerely,

Enid Morhaleck

September 12, 2001

TO: George Johnson
Minnesota Planning Agency
Animal Agriculture GEIS
658 Cedar St. Room 300
St Paul, MN 55155

FROM: PEOPLE FOR THE ETHICAL TREATMENT Of ANIMALS
501 Front Street
Norfolk, VA 23510
Tel: 757-622-PETA
Fax: 757-622-0457

Dear George Johnson:

People for the Ethical Treatment of Animals (PETA) is an international nonprofit organization with more than 750,000 members dedicated to ending animal suffering. On. behalf of our Minnesota members, please accept the following comments, regarding the Draft Generic Environmental Impact Statement (GElS) on Animal Agriculture.

We appreciate the Environmental Quality Board's recognition of the need for humane farming standards in order to improve conditions for animals used in agriculture. We are also thankful that the board has heeded the public's growing concern over a lack of such standards and has created the framework to include relevant language in its Draft GEIS. Aside from the improvements made to animal welfare by doing so, Minnesota's residents will also benefit, as shown by a recent poll which fund that many U.S. citizens find current and common agricultural techniques to be inhumane. Far example. 86% found the intensive confinement of egg-laying hens unacceptable and 75% opposed the cruel practice of forced molting.

In addition to the recommendations already included in the document, we respectfully urge you to include the following additional provision, taken from the technical working paper on Farm Animal Health and Well-being submitted by Marlene K. Halverson:

Recommendation 1: Farm animals are sentient beings and caretakers and animal production systems shall take into account their basic biological and behavioral needs in construction, operation and management."

Recommendation 2: Animals shall be accorded freedom from fear, hunger, thirst, pain, and discomfort and the freedom to express normal patterns of behavior.

Recommendation 3: Farm animals must be humanely slaughtered and transported.

Recommendation 4: Farm animals shall be accorded freedom to perform natural physical movement and to associate with other animals.

Recommendation 6: Farm animals have a right to humane transport. The transport of downed or disabled livestock should be prohibited.

Recommendation 11: Institute the phase-out of gestation crates and battery cages.

Recommendation 16: Create division within Minnesota Board of Animal Health to enforce regulations regarding health and well-being of individual animals on farms.

Again, on behalf of our Minnesota members, we urge you to help ensure that farm animals in your state do not continue to suffer through the intense confinement, overcrowding, filthy conditions, and painful procedures that dominate today's industry by including the aforementioned recommendations in the final version of the GEIS. We also urge the board to represent growing consumer concerns about preventing inhumane treatment of animals used in agriculture by including an expert on animal welfare issues on any future Citizen Advisory Committee

Thank you for your time and consideration, Sincerely, Gem Akin, Research Associate

August 31, 2001

MN Planning, An Ag GEIS
658 Cedar St, Room 300
St. Paul, MN 55155

Terri Morhaleck
1278 Ellis Mill Rd
Mullica Hill, NJ 08053

Re: GEIS on Animal Agriculture

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I thank you for your time and consideration in this sensitive matter.

Sincerely,

Terri Morhaleck

Date: Fri, Sep 14, 2001

Dear Mr. Johnson,

Note: I am told that today's deadline has been extended to the end of September, but I will submit this for now.

The Human Health section is of primary interest for me in your draft. As I said at the hearing in Rochester on Sept. 4, the recommendation on antibiotic use (#2) is very weak. Antibiotics should be limited to therapeutic use, period.

I do come from a family of veterinarians (my stepfather, retired, was a large animal vet in Iowa) so I also commented in favor of the Animal Welfare recommendations, though I find the wording quite weak. The GEIS summary I took home from that hearing (being unable to call it up on our Macintosh computer) points out that the MN Board of Animal Health deals with contagion and spread of disease (I have sat in on their quarterly meetings) and not primarily with the health and well-being issue. And that you recognize there is a gap in protection of farm animals in Minnesota (p. 176).

A veterinarian named John Frltz from Lewiston, Winona County, testified against inclusion of the animal welfare section recommendations in Rochester, saying the money would be better spent elsewhere. He told me afterward that his expertise was in dairy, not hogs or poultry, and I wish that qualification had been made to the audience. It is commonly accepted that dairy cows get much better treatment (because of replacement cost, if no other reason). Of all 18 original recommendations in the Animal Welfare TWP, I would support #11 calling for phase outs of gestation crates for sows and battery cages for laying hens. I cannot stress this enough.

To improve wording of the 4 recommendations:

#65 Change "establish" to "mandate" humane codes

#67 Leave out the word "voluntary"

#68 Change "consider" to "require"

Veterinarians are very influential on these matters--Sen. Steve Dille in particular, who is in touch with the State Board of Animal Health two or three times a week when the Legislature is in session according to staff in that office. Few practicing vets have the courage to speak out publicly. One vet's statement supportive of rotational grazing submitted for a public hearing in Northfield in 1994 never found its way into the 1995 Corporate Farm Law Task Force Report published by the Dept. of Ag, despite repeat requests.

You said at the Rochester hearing that Sen. Dille was the only veterinarian you had been able to talk to, which is very unfortunate. Dr. James Wilkus of Kenyon has been a good resource person on things like comparable potency of manures from the various livestock groups and I suggest you contact him. He now works in the Food Safety Division of USDA in Washington, DC (202-205-0252 office unless there were changes under Pres. Bush). He gets home to Kenyon frequently (507-789-6144).

My disappointment with this GEIS draft is that you admittedly did not pursue comparisons of the different production systems (p.10). Without a moratorium in place to ensure the project would proceed in earnest, the committee (overbalanced by large ag interests) was evidently able to steer clear of what should have been central to the project. It is an opportunity lost.

Stephanie Hendrickson
R.I
Dundas, MN 55019

From: Michael Appleby
Date: 9/14/01 10:57AM
Subject: Draft GEIS for Minnesota

Dear George Johnson

Draft GEIS for Minnesota

I write on behalf of the Humane Society of the United States, the largest animal protection organization in the country, to comment on the draft Generic Environmental Impact Statement on Animal Agriculture in Minnesota. We believe that humane treatment of animals is integrally associated with other important aspects of animal agriculture, for example its impacts on human health and communities and on the environment. We are pleased that you have recognized this by including the topic in the process leading to the statement and in the statement itself, with several recommendations for policy.

We note the strength of your comment, on page 175, that ‘Animal health and well being are the foundation of any humane, sustainable livestock production system'. As the imperative need for sustainability is the basis of the GEIS, we conclude that animal health and well being should be the foundation of ALL livestock production systems. We therefore make the following specific points.

1. W e endorse the importance of the eight themes given on pages 15 to 17, and are particularly delighted that Theme 6 suggests commitment of resources to ensuring farm animal welfare.

2. We are puzzled by the phrase in Theme 3 on human health issues, 'Human health before animal welfare'. This seems to imply that favoring animal welfare could sometimes be detrimental for human health. On the contrary, proper care of animals is necessary both to prevent transmission of diseases from animals to humans and to ensure food safety. Halverson presented evidence on this in her seeping paper on this topic. We strongly suggest alteration of this phrase to read something like the following: Human health and animal welfare are compatible; or Promotion of human health, aided by promotion of animal health.

3. In view of the central importance of this topic and its association with all the other aims of the GEIS, we trust that recommendations 65 to 68 on animal welfare will be retained in the final version.

4. W e note, however, that there are many suggestions in Halverson’s TWP paper that have not yet been included, and urge that these be reconsidered. Perhaps the most important of these fall into two categories:

It is vital that the general principle given above - that animal health and well being should be the foundation of all livestock production systems -should be more widely recognized.

W e strongly suggest that it should be included as a recommendation, probably the first recommendation on animal welfare. This could follow Halverson's first suggestion (following the European Union in recognizing that farm animals are sentient beings), her second (that their care should take into account the Five Freedoms) or both.

Animal transport and slaughter are not explicitly mentioned in recommendations 65 to 68, despite the fact that many severe problems for welfare occur in these processes. For example, we know that even existing legislation such as the Humane Slaughter Act is not fully applied. We suggest that one or more additional recommendations should be made stressing the critical importance of these issues, based on Halverson's suggestions 3 and 6.

5. W e also note that the commitment of resources to ensuring farm animal welfare promised in Theme 6 is not reflected in recommendations 65 to 68. For example, recommendation 66 is to 'Research animal production methods that foster animal welfare'. Well, much is already known on such methods. We request that this recommendation should be modified to read 'Research AND SUPPORT ADOPTION OF animal production methods that foster animal welfare'.

6. Similarly, recommendation 68 is relatively weak, that 'The state should consider farmer and farm worker certification programs to ensure that the people responsible for animal care understand the basic principles of animal biology and behavior'. We request that this should be strengthened. One possible modification might be: 'The state should ensure that the people responsible for animal care understand the basic principles of animal biology and behavior, for example by farmer and farm worker certification programs'.

7. In the body of the Statement, the section on Animal Health and Well-Being is welcome, and we have commented above that the strong emphasis placed on this topic is entirely appropriate. However, the way in which that emphasis is interpreted is less satisfactory: much of this section is a presentation of the industry's viewpoint - inevitably partial - rather than an up-to-date scientific review. We were impressed with Halverson's scoping paper on this area and we urge you to incorporate more of her material into your final version of this section, in place of some of the industry-oriented material it currently contains. This section should be a description of what we are striving for, rather than a defense of the status quo.

I congratulate Minnesota Planning for its vision in taking the issue of farm animal welfare seriously, both for the contribution it makes to sustainability of livestock production and for its own intrinsic importance.

For your information, I have worked as a scientist on farm animal welfare for more than 20 years, mostly at the University of Edinburgh, UK. I have published many scientific articles on the subject and a number of books: most recently, 'What Should We Do About

Animal Welfare?' (Blackwell's, 1999). I am pleased that this topic is now beginning to receive the prominence it deserves.

Yours sincerely,

Michael Appleby

Dr MC Appleby
Vice-President, Farm Animals and Sustainable Agriculture Section
Humane Society of the United States
2100 L Street, NW
Washington DC 20037

TO: MN Planning
FROM: William Burgess
RE: GEIS on Animal Agriculture

September 01, 2001

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I thank you for your time and consideration in this sensitive matter.

Sincerely,

William Burgess

To: Minnesota Planning Animal Agriculture
GEIS 658 Cedar St., Room 300
St. Paul, MN 55155

JRB Associates, Inc.
2462 Lake George Drive N.W.
Oak Grove, MN 55011
Richard L. Boniface & Juanita J. Reed-Boniface
Phone 763-753-4636 Fax 763-753-5663

September 14, 2001

Re: Comments on the Animal Agriculture GEIS

We would like to submit the following comments on the Draft General Environmental Impact Statement on Animal Agriculture.

JRB Associates, Inc. is an agricultural consulting firm. One of our major clients is Minnesota Foundation for Responsible Animal Care, a state-wide organization dedicated to responsible animal care in every aspect of animal use. Constituents of Infract include all production livestock organizations, feed grain commodity groups, biomedical research firms, University of Minnesota, Minnesota Veterinary Association, veterinarians, farms and private individuals. Juanita is also a beef producer and active in a number of agricultural -related organizations in Minnesota including Minnesota Cattle Women, Minnesota State Cattlemen's Association and Minnesota Agri-Women; and a faculty member (retired) of the University of Minnesota Extension Service. Dick worked in agricultural commodity marketing specifically with wool marketing for over 40 years.

We would like to comment on the specific recommendations in the Animal Welfare Policy Section:

65--While we agree that humane codes of practice are appropriate, we oppose any recommendations that would move this into the status of a statute, or that would create undue hardship for farmers and ranchers. In reality, species groups have already established "codes of practice" or "statements of principle" that reflect humane animal care. For example, beef producers have adhered to the Cattlemen's Statement of Principle developed by National Cattlemen's Beef Association for at least ten years.

#66 – Research on animal welfare and responsible animal care are on-going at a number of land-grant universities around the country. We are most familiar with the work being done by animal scientists Dr. Temple Grandin at Colorado State University and Dr. Jeff Armstrong, Purdue University. Dr. Grandin has spent over 20 years in this field . As a result of her work dramatic changes have been made in livestock handling practices, housing and facilities, and handling in animals in slaughter houses. MnFRAC hosted an Animal Handling Forum this spring with Dr. Grandin as the featured presenter reaching over 400 animal agriculturists. Follow-up news reports in regional media carried the message to countless of others.

The research is well underway--the bigger challenge is to provide adequate funding for University of Minnesota research, teaching and outreach so that quality research can continue and indeed be disseminated through classrooms and extension programs.

#67-This is a good recommendation as long as it is VOLUNTARY. Through the Beef Quality Assurance, the Dairy Quality Assurance and the Pork Quality Assurance programs conducted by the Beef Council, the Pork Producers and the University of Minnesota, hundreds of Minnesota producers are quality assurance certified. All of these programs have been conducted on a voluntary basis.

During the past year MnFRAC in cooperation with Minnesota 4-H has initiated a quality assurance and livestock ethics program for young producers. By 2002 we expect that nearly 3000 4-H members, volunteers and extension educators will be certified in this program. A new policy will require that all 4-H members must be certified before exhibiting livestock at the 2002 Minnesota State Fair.

Producers like ourselves want to deliver a safe, consistent quality product to the consumer and are willing to take the necessary steps to become certified without legislation. All of the persons working with our beef herd are Beef Quality Assurance certified. Not only does this certification assure our proper handling of our livestock, but it also gives us an economic advantage at point of sale.

#68--Like #67, the concept is good as long as it is voluntary. We would like to hope that all persons working in animal agriculture understand the basic principles of animal biology and behavior. Indeed most of the farmers and ranchers today are well educated animal scientists. However, continued education is important as new discoveries about animal biology and behavior are made; and as the role of managers and employees in animal agriculture change.

The bottom line is do not legislate or regulate issues that are being addressed by the industry on a volunteer basis in a timely and far reaching way.

Sincerely,

Juanita Reed-Boniface
Dick Boniface

From: Lori Korell
Date: 9/9/01
Subject: Feedlot Study

Dear Sirs:

I am a Minneapolis homeowner and resident writing to express grave concern on how animals raised for food are treated. I have read the information at http://www.DefendingFarmAnimals.org and http://wvnv.banbatterycages.org and find the conditions for these animals totally unacceptable. I believe many farmers even agree that conditions are unacceptable, but they find themselves pulled into "industry standards" for raising these animals--simply in order to "keep up."

I find the "profit motive" an unacceptable excuse for these deplorable conditions. It is your responsibility to develop guidelines that will provide not only more humane standards for these animals, but also guidelines that are economical--that's right, I believe that ultimately the most humane methods will also prove to be the cheapest (to the dismay of the battery cage manufacturers and those industries that depend on the farmer purchasing such instruments of torture, as well as the dismay of the pharmaceutical industry).

Conditions that are more humane for animals will, in the end, result in much less disease, less death, less infection, less need for antibiotics and drugs, less parasite infestation, less behavior problems (tail biting, pecking) and a much healthier animal all around. Every year, 26.4 million tons of antibiotics are used on farm animals and their feed (for reasons other than disease) and that amount would decrease, resulting in much healthier food for humans.

Regarding the sad state of the egg-laying chickens at the Michael Foods facility at the Ban BatteryCages site, I am outraged that battery cages are banned in Europe, but are routinely used here. I find the procedure known as "force-molting" revolting. I find the stacked cages with slanted floors unacceptable. In fact, these conditions cause the hens to go "mad" and peck at each other--and who can blame them--housed with 80,000 others, forced into small cages, unable to do anything they are designed by nature to do, such as pecking the ground, dust-bathing and so forth. The ag industries solution of debeaking (or cutting of the animals' feet) is unacceptable as well.

It is an outrage that animals raised for food are exempt from animal cruelty laws--without doubt, these animals certainly suffer the most cruel treatment of all. They are denied their natural instincts. They live in totally artificial and manufactured environments--most often large windowless buildings with concrete or slatted floors, and little or no ventilation (most hogs suffer from pneumonia because they must inhale noxious ammonia fumes). In fact, many animals never see sunlight until the day they are prodded onto a truck on their way to slaughter.

Their inadequate housing is designed to be as cheap as possible, restrict their movement, restrict their muscle development/calorie expense (in order to maximize market weight at any expense), restrict their contact with their young (assuming they are even allowed contact with their young--I am writing here of veal calves), cause them to suffer deformities as the result of standing on slatted or concrete floors (hogs), restrained in cages/tethered by the neck to cramped stalls (hogs/veal calves), forced to eat an unnatural diet (cattle given grain as opposed to their natural grazing diet--resulting in beef having 30% more saturated fat), much of their "feed" containing ground up carcasses and chicken manure, etc., hogs only drinking water being their own urine, and so on.

The entire "animal agricultural" industry ought to be ashamed of itself. It is shameful that Europe's standards exceed those in the U.S. Because of what I have learned about how these animals are treated, I have become a vegan , as has my husband, my sister, her husband and their two children. My mother has cut back on meat. Another of my sisters purchases only organic meats for her family. My father persists in eating large quantities of meat but has had surgery for prostate cancer. It is now time to make conditions for these animals more humane. The word is out--the message being spread by word of mouth, numerous books, organizations and web sites such as those listed above--society will not tolerate the poor treatment of these animals that are so capable of pain and suffering.

Sincerely,
Lori J. Korell
2718 Benjamin Street NE
Minneapolis, MN 55418

September 6, 2001

From Nancy Gundersen
806 South 6th Ave.,
St. Cloud, MN 56301

Subject: Comments on Generic Environmental Impact Statement on Animal Agriculture

I would like to commend all those who worked on this report. The information on animal agriculture will be helpful to both decision makers and the public.

I would like to address the problem of animal welfare on farms, especially on the large chicken and hog operations and the way the report handles this issue.

An unusual situation has developed. While significant advances in the understanding of animal complexity and needs has occurred on the scientific front, at the same time, farm animals are experiencing dramatically different living conditions than what they had a few short years ago, living conditions that recognize only a very limited number of animal needs.

We now have "factory farms," where very large numbers of animals live indoors together all of their brief lives, are frequently confined to very small spaces, are often crowded. They cannot move freely, dig or scratch in the soil, make a birthing nest, have personal space. We all probably know at least some of the particulars, either through personal experience or through the media.

I think the document could do a better job of looking at this issue.

I also have some specific suggestions for the document. I would like to see at the beginning of Chapter 13, "Animal Health and Well-Being," a brief summery of major federal and state regulations on animals, as was done in Chapter 7, where major federal and state farm programs were reviewed.

On page 179 of the report, it is stated that "The fundamental producer premise is that high levels of productivity from farm animals (and the closely related absence of diagnosable morbidity) are sufficient evidence that animals are well cared for and have an acceptable level of well-being."

Although the report goes on to discuss how productivity and animal well-being are not necessarily the same, it does not challenge the statement that there is an "absence of diagnosable morbidity." My understanding, from personal experience in south central Minnesota (Martin County) and in talking to small hog producers, is that the death rate is significantly higher for hogs in large-scale confinement situations than in more conventional, smaller operations.

In addition, I have heard from numerous sources about the inherent dangers of indoor confinement for herd and flock animals. I am told this is where animals are more likely to become sick. Animals are biologically conditioned to live outdoors, even in the cold. Again, the document does not discuss this issue and give it weight.

Early in the study, there are the Consensus Policy Recommendations, with #65-68 being concerned with animal well-being. These recommendations are helpful, but extremely limited. I would prefer to see, either in the recommendations or, if that is not possible, in the chapter on animal well-being, a proposal for at least a minimal standard of animal care below which producers could not fall, however economically advantageous.

I am also concerned about the workers in large scale animal confinement units. When farms become big business, with many animal units and a number of paid workers, I think they should assume additional responsibility for their workers, like any other business. Standard # 9 "Encourage worker safety plans for feed lots" is extremely small protection for workers laboring in the bad air of hog confinement and chicken raising facilities."

From: Lisa Leopold
Date: 9/7/01
Subject: LEAP Alert: FEEDLOT STUDY

September 7, 2001 LEAP ALERT:

LAST CHANCE TO REDUCE INTENSIVE CONFINEMENT, FEAR AND PAIN FOR FARMED ANIMALS

Here is a great opportunity for you to make a difference for Minnesota's farmed animals and to speak out against the inhumane confinement practices they endure on a daily basis.

Please attend a meeting on Monday, September 10, from 6:30pm to 9:30pm at the University of Minnesota's St. Paul Campus to express your concerns about cruel farm practices in Minnesota (location and directions are below).

This meeting is the last of several in the state that have been held by a Citizen's Advisory Board to review the Generic Environmental Impact Statement (GEIS)--also known as the feedlot study--that was funded by the 1998 Minnesota Legislature. The purpose of the GEIS is to develop a plan for future animal agriculture policy in the state.

The GEIS plan contains first-ever recommendations for statewide standards on animal health and well-being based on ethical and scientific research by internationally respected animal welfare scientists. Minnesotans concerned about the treatment of animals used in agriculture may want to review the information available at the GEIS website: www.mnplan.state.mn.us.

The GEIS Citizen's Advisory Board that developed the plan included representatives from MN Pork Producers. MN Cattlemen's Association, MN Agrigrowth Council, MN Farmers Union, The Turkey Store and other animal industries as well as environmental, educational and civic organizations. Animal advocacy representatives, even vets, were excluded from membership on this Advisory Board.

MEETING LOCATION: Monday, September 10 6:30 - 9:30 pm
Earle Brown Center, Room 135 1890 Buford Avenue
University of Minnesota St. Paul Campus

PLEASE MAKE YOUR VOICE FOR FARMED ANIMALS HEARD! IF YOU CANNOT ATTEND THE SEPTEMBER 10 MEETING IN ST. PAUL, PLEASE SEND YOUR WRITTEN COMMENTS BY SEPTEMBER 14th TO:
MN Planning, Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155
Fax: 651-296-3698,
Attn. Animal Agriculture GEIS e-mail: Johnson@mnplan.state.mn.us

For graphic evidence of livestock abuse in Minnesota go to:
http://www.DeiendingFarmAnimals.org http://www.banbatterycages.org

DIRECTIONS TO ST. PAUL CAMPUS:

Going west on Highway 36: Follow Highway 36 to the Cleveland Ave. exit. Follow Cleveland Ave. south past Larpenteur Ave. Take a left onto Commonwealth Ave-parking lot S101 is immediately to your left. You may also continue on to Gortner Ave. Take a left onto Gortner Ave. At Buford Ave. take a right. Parking lot S102 is on the left - continue straight on Buford Ave. to get to parking lots 5104 and s108.
I-35W north through the cities: Follow I-35W north to the Cleveland Ave. exit. Follow Cleveland Ave. south past Larpenteur Ave. Take a left onto Commonwealth Ave - parking lot S101 is immediately to your left. You may also continue on to Gortner Ave. Take a left onto Gortner Ave. At Buford Ave. take a right. Parking lot S102 is on the left - continue straight on Buford Ave. to get to parking lots S104 and s108.

I-35W south into the cities: Follow I-35W south to the Cleveland Ave. exit. Follow Cleveland Ave. south past Larpenteur Ave. Take a left onto Commonwealth Ave - parking lot S101 is immediately to your left. You may also continue on to Gortner Ave. Take a left onto Gortner Ave. At Buford Ave. take a right. Parking lot S102 is on the left - continue straight on Buford Ave, to get to parking lots S104 and s108.

1-94: Take Snelling Ave. north to Como Ave. Go west on Como Ave. to Cleveland Ave. Take a right onto Cleveland Ave, and follow it to Commonwealth Ave. Take a right onto Commonwealth Ave - parking lot S101 isimmediately to your left. You may also continue on to Gunner Ave. Take a left onto Gortner Ave. At Buford Ave. take a right. Parking lot S102 is on the left - continue straight on Buford Ave. to get to parking lots S104 and s108.

Legislative Efforts for Animal Protection (LEAP) http://www.leap-mn.org
leap@leap-mn.org
952-903-4999
PMB 102
5021 Vernon Avenue

Edina MN 55436

To unsubscribe, reply to this e-mail and type "unsubscribe" in the subject line.

Please protect animal rights in Minnesota.

Lisa Leopold

Christopher Coen
3639 14'° Ave., S.
Minneapolis, MN 55407
612-724-0469

September 14, 2001

George Johnson
c/o MN Planning, Animal Agricultural GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Re: Generic Environmental Impact Statement (GEIS)

Dear Mr. Johnson,

I would lime to submit my comments for the Animal Agriculture Genetic Environmental Impact Statement (AAGEIS).

I would like to address Topic L - Animal Health and Well Being. Please be aware that the "Well Being" component has somehow been omitted from the topic title to section L on page ii of the Public Review Draft of the GEIS.

I think the most notable aspect of this section of the GEIS, as well as the way this subject has been treated by the Minnesota Environmental Quality Board (EQB) is the fact that all animal welfare interests and groups, even veterinarians, were simply not included on the Citizens Advisory Council (CAC), the so-called public representative body entrusted to put together this document for the Minnesota Legislature. This in spite of the fact that the CAC was supposed to represent diverse interests. Upon examination of the groups represented on the CAC, one notes that it is primarily composed of public groups who have benefited and derived profits from the use and exploitation of animals in agriculture. Then is an over-representation of groups with vested interests in looking not at the welfare of animals per se, but in looking mainly at the bottom line - profits. Alternatively, there is zero representation of public groups who look in full or large part at the actual welfare of animals.

This set-up, in conjunction with the highly irregular rule that governed the decision-making process of the CAC, calling for 100% unanimous agreement for specific recommendations in order that they be included in the Draft version, has resulted in a set of guidelines and recommendations for out Legislature that will leave out the vast majority of potential recommendations that could have addressed the chronic animal welfare problems we have been experiencing in Minnesota's animal agriculture industry. The very few animal welfare topic recommendations that have made it into the GEIS Draft version, have also been significantly weakened, to the point of being completely toothless and unenforceable. No recommendations were even included, that would deal with the already chronic problem of current laws and guidelines going un-enforced. The overall CAC structure has been instrumental in preventing any real addressing of the on-going animal welfare problems that Minnesota animal agricultural has been now mired in for years.

In specific regard to the four animal welfare recommendations that made it into the GEIS Draft version - 14 were eliminated - it should be noted that all have had qualifying language incorporated into them, that render them virtually toothless, and unable to truly address the current problems with animal welfare. An example of this is recommendation #67 that calls for certifications programs that include basic animal welfare standards, which should be "voluntary". This qualification insures that the recommendation will be unenforceable. Similarly, recommendation #68 reads that the state "should consider" farmer and farm worker certification programs to ensure that the people responsible for animal care understand the basic principles of animal biology and behavior. This qualifying language, yet again, foreshadows the inevitable inability for any one to ensure compliance of this essential requirement for animal welfare. This is a very important point, as even current requirements of the law, are being routinely ignored by industry, which is then either ignored by the Minnesota Department of Agriculture and/or completely un-enforced or is treated with a slap in the hand.

Recommendation #66 is problematic in that it assumes that animal welfare production methods can very likely be economically unfeasible, when in point of truth, production systems that consider the health and well-being of animals are the very bedrock of sound animal agriculture, as well as human health. The un-healthful crowding of animals at current facilities, overuse of antibiotics, stress and death of animals caused by trucking them in extreme weather conditions, use of rendered animal feed, rendering of downed animals that may be infected with dangerous diseases, and the dreadful effects of stress from restriction of natural biological behaviors, are the very cause of the economically disastrous long-term consequences to both the industry and human health. Animal welfare production methods and systems are not only essential to economically feasible systems, but are dependent upon them. Recommendation #66 both ignores this fact, and attempts to state the reverse.

Among the crucial 14 animal welfare recommendations dropped out of the GEIS Draft document is the absolutely essential foundational tenant of the animal and human welfare subject - that animals are "sentient" creatures, whom, by virtue of this very fact, require more consideration than merely being thought of as products or as "bio-machines". The "yield loss" concept is intolerable in an industry dealing with living beings. The refusal to accept the fact that non-human animals are sentient beings, is the very basis for the wholesale and systematic violations of their basic health and well-being, and therefore the health and well-being of humans who are affected by the resultant diseased meat, anti-biotic resistant bacteria, hormone-laden milk, and the damages to our natural environment from the extreme and dense concentration of animals at sites throughout our state.

I implore the CAC and the EQB to put the dropped animal welfare recommendations back into the GEIS, and to word them so that they are enforceable, and therefore, of any use to resolving current problems.

The evidence of widespread and systematic violations of animal welfare and of animal welfare laws, such as the Humane Slaughter Act, has been well documented by the Minnesota citizens group Defending Farm Animals. They have recorded repeated fundamental and chronic violations of animal welfare occurring throughout the state, even within three miles of the Minnesota Department of Agricultural in the town of Concord. At that location, sows have been repeatedly butchered while fully conscious, by being hoisted up by their legs from chains and stabbed repeatedly in the throat. These particular incidents represent just a microcosm of the widespread violation of the Humane Slaughter Act and other laws and guidelines, which has become routine in our state. Laws on the books intended to protect animals from the worst abuses are regularly going un-enforced.

Recommendations #21 and #29 that would strengthen enforcement against non-compliant facilities should also be made a priority. Recommendation #57 suggesting inspections of feedlots should be changed to "requiring" inspections. This recommendation is paramount to addressing the problems at the feedlots. Furthermore, it is absolutely essential that the inspections be unannounced and conducted at random times. Industries have shown a pattern of fixing-up deficiencies only for times of inspections, and violating requirements wholesale during all other times, in a single-minded effort that focuses only on bottom-line profits. Long-term damaging health and economic consequences for our society have thus ensued, and then been papered-over and white-washed by animal husbandry profiteers and vested interests.

The final animal health and welfare recommendations included in the AAGEIS should be addressed in the larger necessity of ensuring that Minnesota and it's industries operate under the highest standards. It is of great importance that we look to the European Union, Sweden, and the United Kingdom, all of whom have set the highest and world's most advanced standards in animal agricultural industries. Minnesota must match or surpass their excellent systems, in order to ensure public confidence, as well as the reputation of our great state.

Respectfully,
Christopher Coen

Statement Made to The Environmental Quality Board and the Citizens Advisory Committee Regarding the draft Generic Environmental Impact Statement on Animal Agriculture

Monday, September 10, 2001

Earle Brown Center, St. Paul

Good Evening, my name is Peter Erdman, I am a resident of Eagan, MN and the co-Director of Defending Farm Animals, Inc.

Defending Farm Animals is based in the Twin Cities and has the mission to improve the welfare of farm animals through public education, and investigations.

I like to call myself a reluctant activist – this activity is really not something that I enjoy doing, however, I feel that it is a vitally important issue. I own a software development company, and prefer that type of work far over activism. Everyone at Defending Farm Animals is a non-paid volunteer. Most of the funding for our activities has come from the three founding members.

Growing up in rural Rochester, I was unaware of much of what goes on behind closed doors of modern food production.

When founding Defending Farm Animals we set out to educate ourselves on the issue by gathering information first hand – not relying on information from either side of the issue. This investigation work has been very enlightening and has dispelled myths from both animal activists as well as those from agriculture.

In this process of educating ourselves, we have gathered thousands of photos and many hours of videotape. All of this is from the past couple of years from the greater Minnesota area. This material is not pretty and continues to haunt me everyday.

All DFA investigators have been threatened physically in the past three years while gathering this information.

We have taken this information to the public through several mechanisms including a weekly television show, a web site, and two mobile multi-media exhibits.

The public has responded to the following during our educational outreach:

1.) The public is increasingly becoming well educated on animal issues in modern agriculture, specifically with large corporate facilities. When people see specific examples of abuse and the manner in which the animals are housed, they realize that these issues of animal welfare are very real – they stop trivializing it. They become outraged, angry, and appalled. Their image of where there food comes from becomes shattered and stands in stark contrast to the image portrayed to them by the industry.

They assumed that animals are afforded basic protection – to live their lives in a natural manner, being treated decently, and to die in a pain-free manner.

2.) Public outrage is focused around two central issues:

a. Specific examples of cruelty going on throughout the State including:
i. The handling of downers
ii. The method of killing culled animals such as turkeys and piglets
iii. Trucking of animals in the extreme temperatures of Minnesota. This was painfully evident this past summer with the trucking of animals during the heat wave, despite Industry recommendations against such transportation given the heat index. For the given heat index, the recommendation graph indicated absolutely no transportation of animals. Yet South St. Paul had many trucks loaded with hogs during the heat of the day.
iv The loading of poultry, specifically turkeys and culled hens, in and out of trucks.

b. The systematic confinement of animals, specifically the massive operations in Minnesota for sows and egg laying hens. People have no idea this type of extreme life-long confinement is going on in their own backyards, let alone being the supply chain to their own dinner plates.

These animals should have such basic freedoms as:
i. The ability to turn around
ii. To stretch their limbs
iii. To be allowed to conduct behaviors natural to them. Modern confinement systems allow none of these.

Recommendations

1.) Take animal welfare seriously. Be proactive against increasing public pressure to address practices that are done behind closed doors.

2.) Don't assume good economics and production efficiency equates with good animal welfare. Animals are individuals not commodities. The figure of merit of production economics and efficiencies are generally expressed in terms of yield. In my business I would be happy with a small yield fallout if it meant an overall improvement in efficiency. However, I deal with inanimate objects. With agriculture this "yield loss" is living, breathing, and feeling animals. Looking at the animal population as a whole should never be used as a figure of merit of animal welfare. The disposition and dispatch of individual lives must be examined in context of the overall animal welfare system.

3.) Make Minnesota a leader for zero tolerance of blatant animal cruelty in any part of agriculture. We have experienced a dismal and blatant disregard for any type of law enforcement in the area of farm animal abuse. Case in point. Within the past 18 months we gathered extensive evidence of hogs (among other animals) being shackled, hoisted, and cut while still fully conscious. This consciousness was evidenced by eye contact, trying to right themselves, and vocalization. Other hogs were placed in a scalding tank while still conscious. The evidence was from several different days and in more than one facility. We prepared affidavits and submitted the video evidence to the Washington County prosecutor. In both cases the prosecutor chose to not purse the case, patently refusing to discuss his reasons or rational, stating that it was completely up to his own discretion and no justification to anyone was warranted.

What became to be even more disturbing is the routine response given to the public by the Minnesota Department of Agriculture when folks called in to inquire about the incidents. The Department of Agriculture stated that the problem has been completely solved, the people involved were prosecuted, and the video evidence was "several years old." Calls to the Board of Animal Health resulted in the same response. Clearly a choice was made to obfuscate the public about these incidents by the very government agency charged by Minnesota Statute to have oversight of these areas.

This callous disregard for the well being of farm animals and the upholding of Minnesota law will eventually swell into a major public issue.

Please support those of us who are working hard to improve the conditions of farm animals in Minnesota in a responsible, practical, and compassionate manner.

Thank you

From: Karen E. Purves
Date: 9/14/01 5:01PM

Subject: GEIS comments

September 14, 2001

MN Planning, Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul MN 55155

To whom it may concern:

The Animal Protection Institute--Midwest Regional Office, on behalf of over 1,100 members in Minnesota,
submit the following comments on the GEIS for creating standards on animal health and well-being for farm animals in the state of Minnesota.

Our comments address Beef Cattle, Chickens, Turkeys, Pigs, Dairy Cattle and Veal Calves. Our comments are based heavily on the Canadian Agri-Food Research Council's Code of Practice for the Care and Handling of Farm Animals, with some further recommendations. We understand the committee is far along in it's process for determining farmed animal care in the state, and appreciate the opportunity to comment on an issue that will affect so many thousands of animals.

BEEF CATTLE

Shelter and housing:

The design and use of shelter facilities for beef cattle should promote the health, well-being and good performance of animals at all stages of their lives.

Natural or constructed shelter areas should adequately protect animals from weather fluctuations characteristic of the region.

Feedlots and paddocks used during cold seasons must have adequate windbreaks to reduce wind speed
hence the wind-chill effect on cattle.

Housing facilities should be designed and constructed to ensure the animals' comfort and to enhance their good health.

In all types of housing systems, cattle should be free to stand up and lie down comfortably at all times.

Feed and Water:

Diets for all classes of beef cattle should be formulated in accordance with the recommendations of the National Research Council (US) subcommittee on beef cattle nutrition in Nutrient requirements of beef cattle.

Cattle should have access to fresh, clean water at all times. The average daily demand for cattle weighing 500 kg (1100lb) is about 45 L and increases in hot weather up to 90 L.

Adequate feed must be provided regularly.

When cattle are fed in groups, all animals must have access to feed. Whenever restricted feeding is practiced, all animals should have simultaneous access to the feeders so that they may eat at the same time.

Pastures:

Cattle on pasture should be inspected regularly, paying particular attention during high-risk periods (e.g., seasonal change, calving and introduction of new animals to the herd).

Cattle on pasture should have access to sufficient quantity and quality of feed and water.

Salt and mineral as required should be available at all times.

All fences, including electric fences, on pastures and ranges should be safe and maintained in good, functional order.

Cattle on pasture or range should have access to a well drained resting area and to natural or constructed shelter.

Calves:

Present beef cattle management dictates that most calves remain with their mothers for at least five months after birth.

Particularly during the first month of life, calves should be observed daily to ensure that they are adequately nourished and healthy.

Herd Management:

Everyone working with cattle or managing animal facilities must understand and accept their responsibility to prevent unnecessary suffering of animals.

An important skill of cattlemen is the ability to recognize early signs of distress or disease in animals so that the cause can be identified and prompt, appropriate action taken.

Herd Health Management:

All animals and facilities should be inspected routinely, and if necessary, appropriate action should be taken immediately.

Distressed cattle should be dealt with humanely, effectively and promptly to prevent suffering. Abnormal health conditions must receive proper treatment. Sick, injured or disabled cattle in severe distress should not be subjected to the rigors of loading and transportation. These animals should be euthanized or slaughtered on the farm. Under no circumstances should sick, injured or disabled animals be transported either to livestock auction markets or long distances to meat packers.

Auction Markets:

Market operators should refuse to accept animals that are clearly not in condition to be moved through their facilities without further injury or stress.

CHICKENS AND TURKEYS

Hatcheries:

Handling of Neonatal Chicks:

Removal of the chicks from hatching trays (including those rejected for marketing) should not be done by tipping the trays. Hatching trays with live chicks should be moved smoothly and only in a level position. Trays should not be thrown or dropped. Precautions should be taken to prevent chicks from falling off the hatching trays.

Chicks should never be squeezed, except for the purpose of excreta ejection during sexing by vent examination. When chicks are lifted up, individually or in groups, their bodies should be supported. Lifting by the head is unacceptable.

Transportation from hatcheries to growing premises should be initiated properly. Although healthy neonatal chicks are capable of fasting, the transporting process should be swift and should not extend beyond 48 hours.

PRODUCTION OF TABLE AND HATCHING EGGS

Housing:

The heating and ventilation systems should be able to maintain the recommended temperature with reasonable accuracy in order to prevent either overheating or chilling.

Chicken buildings should be capable of maintaining an adequate microclimate (as related to vapor condensation, dust level, ammonia and carbon dioxide) over normal weather fluctuations in a given locality.

Cages should be designed to provide the chickens with a safe and comfortable environment. Cage height should permit standing chickens with free head movement, anywhere in the cage.

Attendants:

Persons working with chickens must understand and accept their responsibility to prevent any form of avoidable suffering. Before being assigned to their duties, workers should be adequately instructed and proven knowledgeable of the basic needs of chickens.

Handling can be stressful to chickens, if conducted improperly. When chickens are being held, they should be in a comfortable body position.

BROILER AND ROASTER PRODUCTION

Housing:

Chickens raised in floor pens should have freedom of movement to be able to stand normally, turn around and stretch their wings without difficulty. DEBEAKING and TOE CLIPPING should not be permitted, nor should so-called forced molting procedures.

TURKEY PRODUCTION

Supervision and protection of turkeys:

Attendants should periodically check turkeys for external and internal parasites. If parasites are detected, corrective treatment must be administered as soon as possible.

Turkeys should be protected from other animals. This protection should prevent both direct and visual contact with animals that cause fear in turkeys.

Feed and Water:

In normal circumstances, all chickens and turkeys should have access to water at all times. Drinking water must be fresh and should originate from an uncontaminated source. In normal circumstances, all chickens and turkeys should receive feed on a regular daily basis. When feeding restriction is necessary, any interruption of feed should not exceed 48 hours.

PIGS

Housing:

Every type of housing system must provide conditions conducive to comfort, good health, growth and performance at all stages of the pig's life. GESTATION CRATES SHOULD BE ELIMINATED.
In any type of housing system, temperature is an important factor. Temperature requirements (thermal comfort zones) vary with the age and size of the pig and the environmental conditions in the housing system used.

Ventilation:

Protect pigs of all ages from draughts. Protection is extremely important for piglets up to 2 weeks of age, newly weaned pigs and sick/injured pigs.

The effects of dust on the health of pigs are not well documented nor are the ways of reducing dust levels in the room. Until ways of reducing respirable dust levels are better defined, follow simple, good housekeeping habits.

Flooring:

All floors must be safe for pigs. Flooring materials differ in their suitability for pigs of different ages. Some characteristics to look for include: a dry, well drained surface, solid nonslip footing, and sharp edges that may cause injury.

Pens And Equipment:

All equipment used in a facility must be the correct size for the type of pig and management system used. All equipment purchases and new construction should be based on the animal's needs.

The design of single housing units should always allow the pigs freedom to stand up, turn around and lie down comfortably.

In the design of group pens, the recommended amount of floor space per pig depends mainly of the following: body size, floor construction, and environmental temperature.

In hot weather floor space per pig may need to be increased by 10 to 15% and may require an even greater increase on solid floors to allow for necessary heat dissipation.

Nutrition and Health:

Pigs should be fed daily, using a diet that meets the basic nutritional needs of given categories of pigs as currently defined the National Research Council (NRC).

Watering:

Drinking water must be available at all times. It should be fresh and free from contamination. Nipple drinkers provide an excellent source of clean, uncontaminated water.

In areas where water quality may vary, test the water regularly to ensure its suitability for the animals.

Health:

Good housekeeping practices such as removing manure, washing down pens, disinfecting and generally cleaning up the facility are essential to maintaining a healthy herd.

Pigs should be checked twice daily for signs of disease, injury or non-competitiveness (for food).

Sick or injured animals should be attended to immediately, preferably moved to a warm, comfortable, draft-free environment.

Entry to barns should be controlled to reduce the risk of disease being either transmitted by people (on boots, etc.), pets, rodents or wild animals.

Medications should be used only on the advice of a veterinarian, following recommended treatment levels.

Long-term treatment or control measures using medications alone are not satisfactory. Appropriate management changes (ie. better sanitation, reduced stocking density) must also be initiated.

Stockmanship:

Before working with pigs, attendants should receive adequate instruction and know the basic needs of the animals entrusted to their care. By recognizing behaviors and other symptoms that indicate discomfort or disease problems, attendants should know when they need to take remedial action or to consult a veterinarian.

To minimize the pigs' excitement, all attendants should wear clothing that looks similar and should make an easily recognized signal before entering the barn or the room.

Pigs should be lifted with care, gentleness and patience.

DAIRY CATTLE

Housing:

General:

Buildings that permanently house cattle should be designed and equipped to maintain an adequate internal environment under normal weather fluctuations in a given locality.

Stalls, tethers and pens must be in good repair, must allow for sufficient freedom of movement, must prevent injury, and must allow the animals to be kept reasonably clean.

A dry lying area should be available to all housed cattle.

At calving time, cows should be provided with separate pens that have solid, nonslip floors and contain appropriate bedding.

Space Allowances:

The space allowance for cattle housed in groups should be calculated in relation to the whole environment, to the size of the group and to the age, sex, weight and behavioral needs of the stock.

Extra space allowance is recommended when housing cattle with horns.
All cattle, whether tethered or in pens, should have enough freedom of movement to enable them to groom themselves, to turn around, to lie on their sternum and to get up and lie down normally. When ties are used, they should not cause injury or discomfort to the cattle.

In renovated or new tie-barn facilities, cattle should be provided with enough freedom to lie on their sternum with the head turned back.

All cows that are tied in stalls at any time during the year should be released routinely for exercise when weather conditions permit.

In free-stall or loose-housing systems, one sick pen with a minimum size of 10m (100ft), equipped with a stanchion or tie for restraint, should also be provided for each group of 40 cows. Sick pens should be designed to allow the temperature to be regulated and drafts to be reduced.

Emergencies and Safety:

All staff should be familiar with all appropriate emergency procedures.

Some mechanized dairy farms occasionally experience problems of stray voltage. Corrective measures to control stray voltage should be discussed with dairy extension personnel or other specialists, and steps should be taken to solve the problem.

Feed And Water

All cattle should receive a daily diet that is adequate for maintaining full health and vigor. The composition of diets should reflect production level, reproduction stage, body size, housing and weather conditions.

When cattle are fed in groups, enough manger or trough space or feeding points should be available to avoid undue competition for feed, particularly if feed is not available ad libitum.

Depending on the size of the animal, it is vital that every calf receive at least 1.5 - 2 L of colostrum as soon as possible after birth and certainly within the first 4 hours of life. Each calf should consume 8-10% of its body weight in colostrum or milk over at least two meals for the first 3 days after birth.

Cattle should have access to fresh clean water at all times.

Drinking water should come from an uncontaminated source.

Health Care of the Herd:

The manager of a dairy operation should develop, in consultation with a veterinarian, sound sanitation and immunization programs, appropriate for the type of facility and management system used. Increased housing density and larger herd size necessitate close attention to prevent disease.

The manager of a dairy facility should maintain a health record, including treatment and medication used for every animal. Medication must be administered by competent personnel.

With the exception of preventive health care programs recommended by a veterinarian, medication should be used only to control clinical disease or to treat injuries. Medication should not be used to replace good husbandry practices.

The dosage, time and the length of application of prescribed medication must follow the recommendation of a veterinarian or, in the case of readily available medication, the recommendation of the manufacturer. Animals must be treated only with approved medication. Requirements for withdrawal of medication before milking or before animals are marketed for human consumption must be strictly adhered to.

PASTURES

General:

Application of fertilizer and chemical control of weeds and parasites in pastures must be timed and applied to prevent any health risk to the grazing animals. Before and during the grazing season, pastures should be checked regularly for poisonous plants.

Pastures where cattle are kept over long periods or permanently during the season should have natural or artificial shelters that provide shade and protection from adverse weather conditions.

DELIVERY OF CALVES; CARE OF CALVES AND YOUNG CATTLE

Delivery and Neonatal Care:

Although delivery without complication is most common in cattle, cows that have difficulties (dystocia) should be assisted by a competent person maintaining high standards of hygiene and using proper equipment.

All newborn calves should be handled gently. After delivery, the initiation of respiration by the newborn calf is of prime concern. Fetal membranes covering the nostrils should be removed immediately after birth.

Cows show a strong tendency to lick newborn calves. Licking hastens drying of the calf and benefits the calf's respiration. Care should be taken to ensure that licking does not damage the umbilical area and cause bleeding.

VEAL CALVES

Housing:

Calves should be housed in conditions conducive to comfort, health, growth and good performance at all stages of their lives. There are many recommended and successful systems available for rearing calves, but the system selected for use must be properly designed to meet the needs of each calf. Producers must comply with the appropriate Construction Code.

Ventilation:

Ventilation systems should be capable of maintaining a suitable microclimate to ensure the comfort and welfare of calves.

Calves of all ages should be protected from temperature changes and drafts.

Light:

In totally enclosed barns, light of sufficient intensity for the calves to observe one another is recommended for a minimum of 8 hours within any 24-hour period.

Individual Stalls:

Stalls should allow sufficient space for individual animals to stand up, lie down or turn around comfortably.

Tethering:

Tethers should not be used in closed stalls. Tethering may allow animals to be kept in open and larger stalls, providing a greater degree of visual contact between calves and greater ease in adopting resting positions.

Group pens:

Group pens should be large enough to allow all animals to lie comfortably at the same time. Group sizes should be kept to a manageable size. Group size is under review and management is the most critical factor.

To reduce the incidence of falling and aggression between calves, as well as providing rest areas, moveable barriers should be used within a group pen.

Group housing involves less restriction on the behavior of calves and allows for greater social contact between calves. Group housing is now widely used in Europe. However, there are inherent difficulties in providing individual care for each calf, and there is increased risk of disease transmission, particularly during the first 4 weeks of life. Calves in group pens require a higher degree of husbandry to ensure their health and well-being. On-going research is being conducted to improve group housing. Producers are encouraged to monitor developments in this form of housing.

Feed and Water:

Producers should be familiar with the basic nutritional requirements of their calves. Producers should be fully aware of the feed products, recommended feeding and mixing procedures, and the feeding programs selected for their calves.

Drinking water and water for feed mixture should be ice free, uncontaminated water, fit for animal consumption.

If not fed ad libitum calves should be fed two or more times per day following a regular routine.

Calf Selection for Veal Production:

The well-being of veal calves during rearing depends on the state of the calf's health on arrival at the veal operation. The calf's health will be affected by its post-natal nutrition and management, the period of transportation, including the time at the sale yard, its management and nutrition on arrival. Calves should be selected carefully, and unhealthy or unfit calves should be rejected. Research has shown that calves are generally healthier when bought directly from a dairy operation than from auctions or sale yards.

Calf Arrival:

Housing facilities to accommodate calves should be prepared before calves arrive on the producer's premises. All pens should be clean, disinfected and dry. All equipment should be operating at a level necessary to maintain a suitable environment for the calves.

Handling Newly Arrived Calves:

Transportation to the veal operation should be planned so that the calves arrive when there are sufficient people available to unload them and care for them immediately.

Calves should be unloaded with care so as to avoid any undue stress. Use of electric prods is not acceptable.

A prophylactic plan should be prepared in consultation with a veterinarian. Such a plan should include: provision of electrolyte/minerals/vitamin mix on arrival, a program of vaccination and preventive medicine and suitable parasite control.

Personnel:

All personnel working with calves should understand and accept their responsibility to prevent avoidable suffering of calves.

Producers should be satisfied that attendants are able to recognize behavioral symptoms that indicate discomfort or disease problems, and when to consult a veterinarian.

Working routines of attendants should be consistent and performed on a regular schedule. Movement of people and equipment in and around pens should be accomplished in a manner that minimizes excitability of calves.

It is advisable that attendants wear clothing of similar appearance and provide an easily perceivable signal before entering the area where the calves are housed.

Health Management:

A basic requirement of a successful veal operation is good preventative health management. A sound health program relies on a valid veterinary-client-patient relationship.

Attendants should regularly check all calves for evidence of disease, injury and external parasites. If external parasites are detected, corrective treatment should be introduced as soon as possible.

Visitors to the barns should be kept to a minimum. Visitors should wear protective clothing and move and talk quietly.

Medical treatments and vaccinations used must be based upon veterinary advice. Particular attention must be paid to dosage (based on body weight),. duration of treatment, accepted drug compatibilities and withdrawal time before slaughter. Always read the label.

Transportation:

Calves of less than 7 days should not be transported.

Transport personnel should be properly instructed in and knowledgeable of the basic facts of animal welfare and should be skillful in handling calves under varying climate conditions.

Transport personnel are responsible for the welfare of the calves for the entire stage of transport.

Please keep us appraised on how the statewide standards develop. Do not hesitate to contact me regarding any of the above suggestions.

Sincerely,

Karen E. Purves, MA
The Animal Protection Institute--Midwest Regional Office
1749 Golf Rd., # 218
Mt. Prospect IL 60056-4070
ph:847-758-9560

FARM SANCTUARY
P.O Box 150 Watkins Glen, NY 14891 607-583-2225
P.O. Box 1065 Orland, CA 95963 530-865-4617

August 27, 2001

To: Minnesota Environmental Quality Board

Re: GEIS on Animal Agriculture

I am writing on behalf of Farm Sanctuary, a nation-wide non-profit group that works to protect faint animals through legislation, litigation and education. Farm Sanctuary operates the nation's premier shelters for abused farm animals in New York and California with support from our over 75,000 members, many of them in Minnesota.

I am glad that the Minnesota Environmental Quality Board is considering policies which "Establish humane codes of practice for Minnesota animal agriculture that reflect scientific knowledge and public concerns regarding the health and well being of agricultural animals, Research animal production methods that foster animal welfare. It should be the goal to promote systems that are both supportive of animal welfare and economically feasible. The basic animal welfare practices should be disseminated widely among educational institutions in the state." This is a good step in the right direction of promoting environmental, human, and animal well-being.

However, it must be recognized that it is impossible to both foster animal welfare and utilize confinement factory farming practices. Battery cages for egg-laying hens, veal crates, and gestation crates for pregnant sows are three forms of intensive confinement of factory-farmed animals that are clearly inhumane. Not only are they used with complete disregard for animal welfare, but they also put consumers and the environment at risk with the massive amounts of waste generated, the chemicals and antibiotics used, and other risks.

Other forms of animal cruelty on factory farms include bodily mutilations such as de-beaking and tail-docking done without anesthesia These intensive confinement systems and mutilation practices must be done away with, as they have done in the European Union. For more information, please visit www.freefarmanimals.org

Sincerely,
Laura Carver
Farm Sanctuary Campaign Department

1849 Whitaker Ave.
White Bear Lake, MN 55110
August 31, 2001

MN Planning Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Please accept the following comments on the GEIS on Animal Agriculture

Thank you for instituting humane codes of practice, production methods that foster animal welfare, certification programs that include basic animal welfare standards, and farmer certification. In addition to the recommendations you have already adopted, please also adopt the following recommendations included in the technical working paper on Farm Animal Health and Well-being:

Recommendation 1: "Farm animals are sentient beings and caretakers and animal production systems shall take into account their basic biological and behavioral needs in construction, operation and
management."

Recommendation 2: Animals have a right to be free from fear, pain, want, lack of stimulation, and discomfort.

Recommendation 3: Farm animals must be humanely slaughtered.

Recommendation 4: Farm animals have a right to express natural behaviors.

Recommendation 6: Farm animals have a right to humane transport. Downed or disabled livestock should NEVER be marketed.

Recommendation 11: Institute the phase-out of gestation crates and battery cages.

Adopting these recommendations would dramatically improve the lives of farm animals in intensive
livestock systems in Minnesota. Farm animals are sentient beings who feel pain and fear just as cats
and dogs, and they have a right to basic humane treatment. Adopting the recommendations listed above
would dramatically improve farm animal welfare in the state of Minnesota.

Sincerely,

Paul Moss

805 Park Avenue
Mahtomedi Minnesota 55115
651-426-2531
651-407-0882 FAX
toren@visi.com

DATE:October 16, 2001
TO: George Johnson, Greg Downing
FROM: Paul Toren

RE: GEIS Comments

I've been trying to organize my thoughts and concerns about the general tone and emphasis of the GEIS, and find myself reminded of the old story of the legislator trying to write a bill regulating pornography. After several unsuccessful drafts he commented that he couldn't define pornography, but he knew it when he saw it. I can't provide the words, but my feeling is that the following areas need attention before the GEIS meets the adequacy requirements.

Alternatives

As this GEIS document illustrates, the subject of animal agriculture is broad and complex. Ranges of interdependent alternatives exist relative to the economic, personal, social, community, environmental and governmental factors involved in consideration of the future state of animal agriculture in Minnesota. Because of this interdependence and complexity, the development of a small number of comprehensive, specific alternative futures for animal agriculture in Minnesota was not possible.

It may be possible, however, to describe two extreme examples of the possible future conditions of animal agriculture. This is not an all-of-one or all-of-the-other situation, since it is doubtful if either of these extremes actually exist or will ever exist as the normal state of animal agriculture. The reality will always lie somewhere in between. (Note: This is my top-of-the-head example I'm sure you can fill the blanks better than I.)

ALTERNATIVE STATES OF ANIMAL AGRICULTURE	
"Agrobusiness" Alternative	"Traditional" Alternative
Absentee ownership	Owner Operated
Capital intensive, mechanized	Labor intensive, less mechanization
Animal density/area higher	Animals more dispersed
Single species (animal monoculture)	Different species (animal and plant)
More reliance on external sources of young animals, feed, etc (Global input network)	More local sustainable sources of stock and feed (Local input network)
Routine use of antibiotics as growth promoters	Antibiotics used only to treat disease and illness
Animal well-being measured by survival and economic production efficiency	Animal well-being measured by behavioral characteristics
Manure transported and applied away from feedlot locations	Manure used to fertilize local feed growing fields (closed loop)
Operation conforms to air quality, water quality, and land use regulations	Operation conforms to air quality, water quality, and land use regulations

Consensus Recommendations

1. These recommendations should be worded so as to be implementable. I would hate to have to form an "Implementation Advisory Group" a la the Forestry GEIS. Each recommendation should include a specific answer to the question: WHO DOES WHAT?

2. Each recommendation should have specific supporting justification in the body of the document. (See #23 that refers to a program that has no mention in the text.)

3. The recommendations themselves should be action statements based on the document text and should not include additional narrative material. (See #23 again)

4. Placing recommendations at the beginning of the document requires that a reader accept them before reading the supporting material in the separate chapters. Clarity and credibility would be better served if they were placed at the end of, or within, each chapter.

5. If all of the recommendations must be placed together, they should at least be in the same order as the subject chapters.

Animal Well-Being

I recently came across this in the 2000 statutes. Why didn't somebody bring it up at the meetings? If it's real it should be mentioned.

343.21 Overworking or mistreating animals; penalty.

Subdivision 1. Torture. No person shall overdrive, overload, torture, cruelly beat, neglect, or unjustifiably injure, maim, mutilate, or kill any animal, or cruelly work any animal when it is unfit for labor, whether it belongs to that person or to another person.

Subd. 2. Nourishment: shelter. No person shall deprive any animal over which the person has charge or control of necessary food, water, or shelter.

Subd. 3. Enclosure. No person shall keep any cow or other animal in any enclosure without providing wholesome exercise and change of air.

Paul E. Toren
805 Park Avenue
Mahtomedi Minnesota 55115
651-426-2531
651-407-0882 FAX
toren@visi.com

December 21, 2001

Mr. Gene Hugoson, Chair
Environmental Quality Board
658 Cedar Street, Room 300
St. Paul, Minnesota 55155

RE: October 16 Comments on Animal Agriculture GEIS

Dear Commissioner Hugoson,

On October 16, 2001, I sent a memo to GEIS staff outlining my personal concerns about the content of the Draft GEIS, and some suggestions for change. In view of the continuing discussion of this matter, I am resubmitting these comments for inclusion in the public record and distribution to EQB members and appropriate staff.

Alternatives

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Subd. 3. Enclosure. No person shall keep any cow or other animal in any enclosure without providing wholesome exercise and change of air.

I would appreciate the consideration of these comments as the preparation of the Final GEIS continues.

Sincerely yours,

Paul Toren, Citizen Member
Environmental Quality Board

Minnesota Department of Agriculture
October 25, 2001

George Johnson
Minnesota Planning Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

Dear Mr. Johnson:

Minnesota's Generic Environmental Impact Statement (GEIS) is a lengthy and complicated project – especially when addressing a topic as complex as animal agriculture. I commend the GEIS Citizens' Advisory Committee for the hard work and commitment it has shown in developing recommendations over the past two years. As Commissioner of the Minnesota Department of Agriculture, I wish to provide several brief comments on the CAC recommendations. The first two are of a general nature, and the final three are more specific.

First, I believe the report should be amended to provide proper context to the discussion by clearly stating the economic importance of Minnesota's livestock industry. Throughout its history, Minnesota has depended on agriculture as its economic backbone. Despite the urbanization of the state, agriculture remains an economic cornerstone - particularly in rural communities. A quick look at the numbers tells the story:

- Agriculture and the food and fiber sectors generate roughly 17 percent of Minnesota's annual Gross State Product;
- Minnesota agriculture annually brings more than $16 billion into the state through domestic and international exports;
- One out of every five jobs in Minnesota is in the agriculture and food sector:
- One out of every three jobs in rural Minnesota is in the agriculture sector;
- Each farm production job helps create an additional three jobs in all economic sectors;
- Together, the agriculture and food industries are our second largest employer; and
- Minnesota's dairy industry alone employs more Minnesotans than Northwest Airlines, 3M and Target Corporation combined.

The GEIS will serve as an important guidance document for years to come. These facts and others demonstrating the importance of agriculture to our economy must be provided as background if future readers are to have an accurate understanding of what is at stake when discussing the state's animal agriculture industry.

My second comment is related to the first. Because animal agriculture is so important to our state's economy, we must encourage government at all levels to conduct accurate and thorough cost-benefit analyses before adopting any significant new regulations.

To survive in today's global marketplace, Minnesota farmers must compete directly with producers in other states and countries. Many of those states and countries have fewer and less costly environmental regulations. That means our farmers find themselves at a competitive disadvantage before the first seed is in the ground.

Additional environmental restrictions may bring incremental benefits, but as we adopt stricter and more costly regulations, we also add to the financial burden of farmers (small and large alike). At some point, the burden becomes too heavy and the farmers either go out of business or move to a state or country with a less onerous regulatory structure.

Sadly, there is evidence that this is already happening in Minnesota's livestock industry.

- Idaho will soon surpass Minnesota as the nation's fifth leading milk producer;

- Minnesota is losing hundreds of dairy farmers a year. In 1985, Minnesota had more than 22,000 dairy farmers. At the current rate, we will have fewer than 7,000 by the end of the year;

- Last year, the Minnesota Department of Agriculture released a business climate study that showed the state's dairy farmers have disadvantages in key areas such as herd productivity, access to capital, environmental permitting, and land use and zoning laws.

- A recent article in Successful Farming describes how hog expansion is shifting from the U.S. to countries such as Poland, Brazil and Mexico as a result of regulatory pressures and siting challenges that make it difficult to build new facilities in the U.S.

- Davisco Foods International, a family-owned firm based in Le Sueur, Minn., recently announced plans to build a cheese factory in Lake Norden, South Dakota. The plant eventually would require about 65,000 cows to produce milk for cheese. According to newspaper reports, the company decided to locate the new facility in Lake Norden after being convinced that farms in the area could produce enough milk.

Minnesota is losing its share of the nation's milk production because increasingly mobile milk producers are finding more welcoming regulatory and social environments in other states. This decline in milk production has ripple effects throughout our rural economy, especially in processing, transportation, and other ag-related sectors. As we lose farm-level production, we lose jobs in related sectors.

One unfortunate example of this can be seen in Fergus Falls. Last March, Dairy Farmers of America (DFA) announced the closure of its Fergus Falls cheese processing plant. When announcing the closure and the layoff of plant employees, DFA management blamed the move in large part on the ongoing difficulty in procuring enough milk to meet production requirements. This can be tied directly to the erosion of Minnesota's dairy industry over the last two decades.

According to an MDA staff economist, this plant generated a significant amount of economic activity for the surrounding 10-county region. Our data show this plant had a total economic impact of $117 million, creating 1,116 jobs for an area with relatively few employment options.

Few Minnesotans understand agriculture's role in the state economy. As we cope with the effects of the current economic downturn, we cannot afford to disregard or downplay the importance of this cornerstone industry. For that reason, I believe the GEIS document must emphasize this point and clearly explain how economic factors fit into the overall discussion surrounding Minnesota's animal agriculture sector.

Turning now to more specific comments, I share the CAC's concerns with regard to subtherapeutic use of antibiotic drugs in animal agriculture and possible ties to the development of antibiotic-resistant pathogens. I support the CAC's stance on this matter, and I would add a strong recommendation that any new regulation in this area be implemented at the national level and not left to individual states. After all, Minnesota's food supply comes from farms across the country. Therefore, state-level limitations on antibiotic use in livestock would not protect Minnesota citizens from the potential ill effects of antibiotic-resistant organisms. Such limitations would, however, put Minnesota farmers at a competitive disadvantage relative to producers in states where subtherapeutic use of antibiotics is still allowed. Adding such a business cost without any hope of meaningful benefit would be pointless. Therefore, I strongly recommend a national focus - not a state focus - for any new regulation in this area.

My second specific recommendation regards the privacy of information that state or local agencies may collect on livestock producers. Businesses in many sectors must submit sensitive economic data to government entities, and it is a common practice that some types of such data are withheld from the public to protect the individual businesses. Farms are businesses too, and they deserve the same courtesy provided to other businesses. Furthermore, most farms are still owned by one family. To publicize financial figures from an individual farm would open the family's finances for public viewing and expose the family to unwanted solicitations and harassment.
For that reason, I suggest that economic data submitted by individual farmers be withheld from the public unless there is a compelling reason to do otherwise.

My final specific comment is that I support the CAC recommendation on developing a voluntary environmental certification process for livestock producers provided that this process is meaningful both for producers and the general public. I see this as a progressive initiative that has great potential for Minnesota. Several other states have already implemented similar programs, and I am pleased that the CAC has identified this as a high priority. This type of initiative, combined with additional resources through programs such as EQIP can help improve the environment and allow our livestock producers to remain in business.

Environmental considerations should be included in farm business management and planning, but right now many producers look at environmental review as a weapon used by opponents of animal agriculture. The state environmental review process needs to be examined in order to ensure producers can be confident that as long as they comply with federal, state and local rules, they can re-invest in agriculture in Minnesota without fear of trumped up roadblocks.

Like all Minnesotans, I appreciate clean water and air. I also recognize that Minnesota's environmental protections enhance our quality of life. However, I also know Minnesota farmers are fighting hard to stay afloat in a fast-changing and highly competitive global agricultural economy. I hope this GEIS will help Minnesota strike a balance between protecting our natural resources for future generations and ensuring the ability of our farmers to remain in business and enjoy the same quality of life other Minnesotans seek.

Sincerely,

Gene Hugoson Commissioner

GH:CO:ms
cc: Michael Sullivan, Environmental Quality Board

Minnesota Pollution Control Agency
Office of the Commissioner

December 7, 2001

Gene Hugoson, Chair
Environmental Quality Board
658 Cedar Street, Room 300
St. Paul, Minnesota 55155

RE: Draft Final Generic Environmental Impact Statement (GEIS)

Dear Commissioner Hugoson:

We appreciate the Environmental Quality Board (EQB) meeting scheduled for December 10, 2001. This will be an opportunity for EQB members to raise issues and concerns as well as learn more about the draft Final Generic Environmental Impact Statement (GEIS) on Animal Agriculture, and to hear testimony from interested members of the public. The Minnesota Pollution Control Agency (MPCA) has appreciated the open, inclusive process that the EQB staff has lead in developing the draft Final GEIS. The EQB staff and members of the Citizen Advisory Committee had a difficult task before them in evaluating the many benefits and impacts of animal agriculture in Minnesota. The changes this industry is currently undergoing emphasizes the importance of the GEIS effort to understand the broad environmental, economic and social issues surrounding the industry. We commend the effort and dedication put into developing the draft Final GEIS by all involved.

The GEIS process generated considerable information on animal agriculture, and the MPCA found the literature review especially helpful. Having this information brought together in a cohesive manner will surely allow any interested party the ability to further analyze a specific issue should they desire. The collection and analysis of available information is only one step of the GEIS process. The final step in the GEIS process is to use this information to answer the questions raised in the December 1998 Scoping Document (Scoping Document).

In reading the November 26, 2001 version of the draft Final GEIS, the recommendations appear to have been developed without reference to the Scoping Document and thus, it is difficult to determine if the Scoping Document questions were answered. Additionally, the MPCA's review of the draft Final GEIS revolves around the use of the GEIS as a tool and guidance document for a Responsible Unit of Government (RGU) making decisions on environmental review for a specific project. This is important to us because the MPCA is the RGU for the State's large animal agriculture project proposals. One purpose of a GEIS is to address broad issues generically rather than on a case-by-case basis for each individual project. The draft Final GEIS and the background work contain information on some topics that could be useful to an RGU. However, after spending $3 million on this draft Final GEIS, we have been unable to identify an issue, which provides a broad response, that will stands in lieu of a project-specific response during environmental review.

The remainder of this letter covers the following five areas: (1) Background information on the GEIS, (2) RGU expectations of the GEIS, (3) Alternatives evaluation is incomplete, (4) Policy recommendations for the GEIS, and (5) Conclusions.

1. Background information on the GEIS

The Animal Agriculture GEIS was authorized by the Minnesota Legislature during the 1998 legislative session (Chapter 366, Sec. 86). The purpose was:

I. To "study types of projects that are not adequately reviewed on a case-by-case basis" (MN Rules 4410.3800, subp. 1).
2. To address 'tiering' in subsequent project specific EISs. (MN Rules 4110.3800, subp. 5C) Tiering is defined as "incorporating by reference the discussion of an issue from a broader or more general EIS." (MN Rules 4100.0200, subp. 88.) In other words, the Final GEIS was to provide proposers and RGU's with basic information on animal agriculture and to settle at least some of the broad or common issues that were repeatedly being raised in project-specific environmental reviews.

On December 17, 1998, the official Scoping Document for the Animal Agriculture GEIS was adopted and published. Four objectives were laid out in that document:

- Develop a basic understanding of animal agriculture in Minnesota.

- Identify and assess the environmental, economic, health and social impacts - both: positive and negative - associated with animal agriculture as it exists and as it may change, with particular emphasis given to any cumulative effects in the state.

- Identify alternative paths for animal agriculture (including the current path) that can optimize the benefits of animal agriculture in relation to the environment, economy, health and way of life in the state, with particular emphasis on sustainability.

- Seek consensus on the path(s) that Minnesota should strive for related to animal agriculture and as appropriate, develop the recommendations needed to move the state in these desired direction(s).

2. RGU expectations of the GEIS.

The RGU is charged with preparing project-specific Environmental Assessment Worksheets (EAWs) or Environmental Impact Statements (EISs). It is reasonable for an RGU to expect that the Final GEIS will make specific recommendations to answer, or narrow the range of options on, the broad environmental and non-environmental issues common to animal agriculture as defined in the Scoping Document. While the technical working papers provide data and information used to research specific issues, do the calculations and provide the basis for the conclusions and determinations, the draft Final GEIS does not present useable conclusions and determinations for use by RGUs or project proposers when preparing project-specific EAWs or EISs. Thus, we recommend that the format for the Final GEIS be adopted to allow an RGU and a project proposer to see the connections between the Final GEIS, the Scoping Document, and the technical work papers. This would mean using the headings and questions from the Scoping Document, answering each question, and providing the support for the answer within the Final GEIS. This format will allow the RGU to see what information was available and the conclusions reached, and those areas where more clarification, study or project-specific determination is needed.

A. Examples where the draft Final GEIS does not match or is not linked with the Scoping Document. Without a link between the Scoping Document issues and the Final GEIS, each individual project proposer is left to explain and individually justify the selected project components and operational schemes that could have been resolved in the Final GEIS. The problem this causes is that the Final GEIS may not assist in producing reviews that can rely on the Final GEIS for common, similar issues between projects and then focus on the unique aspects of a specific project. Four examples are provided below.

1.) Air Quality and Odor. The Scoping Document indicates on page 7 under Air Quality and Odor that it will study how the emissions vary by system type and what mitigation is available. The draft Final GEIS is silent on what prevention and mitigation options are available and appropriate for which industry type. An RGU must answer, for each project-specific EAW, the following questions: "How effective is a particular mitigation system? Is mitigation required, or does the design of the facility prevent the potential impacts so that additional mitigation is not required?"

2.) Water Quality. The Scoping Document indicates on page 7 under Water that the health risks to humans from contamination of ground and surface waters from animal manure storage, handling and application will be evaluated. When reading the draft Final GEIS, pages 122 - 123, an RGU cannot find an answer to the question posed. Rather the draft Final GEIS provides some statistics and what might be contaminants found in water. No conclusion regarding risk is provided.

3.) Land application of manure. For instance, producers proposing to land apply manure as required under Minnesota's feedlot rules should not be required to analyze potential significant risks to the environment in a project-specific EAW, and perhaps ultimately be required to prepare a project-specific EIS on this issue.

4.) The Final GEIS should be able to clarify that following mitigation requirements contained in Minnesota feedlot rules is sufficient to address potential significant environmental effects, based on the analysis in the appropriate technical working paper.

5.) Earthen storage basins. Similarly, the producer using an earthen storage basin of a particular size and design should be able to use the Final GEIS to understand the risk posed to the general public and the environment and the appropriate mitigation without the need for a site-specific EIS.

B. Broad issues that an RGU might expect the Final GEIS to address.

1.) Generic issues related to environmental topics. The MPCA believes that the following are generic environmental issues common to all livestock operations: land application, manure storage, odor, antibiotic resistance, best management practices for air and water protection, greenhouse gases, human health risks posed by livestock operations, air and water monitoring techniques, and impacts related to chemical application of commercial fertilizers, pesticides and herbicides.

2.) Generic issues related to non-environmental topics. The MPCA believes that the following are generic non-environmental issues common to all livestock operations: social values related to the size of farming operations; relationship between livestock production, processors and consumers; treatment of animals; zoning and land use planning strategies; property rights; animal agriculture industry structure; market inefficiencies and market entry strategies; economies of scale related to the size of farms; and economic cost/benefit analysis.

3. Alternatives Evaluation is Incomplete

Unfortunately, the `Alternatives' section of the draft Final GEIS is almost nonexistent. This topic was deemed one of the most important in the original Scoping Document. It was identified as one of the overall goals of the Final GEIS. Yet, there is not nearly enough information in the technical work papers or the draft Final GEIS document itself for RGU's to evaluate the possible use of alternatives in a given situation. Conceptually, decision-makers faced with an animal agriculture issue should be able to refer to the Final GEIS and explore generic, well-reasoned alternatives. The failure to provide this analysis does a disservice to the public looking for answers and to producers looking for guidance on approaches that will streamline their efforts in developing their business to meet the needs of a changing industry in an environmentally-sound manner.

4. **Policy Recommendations for the GEIS**

A. More focused conclusions are needed. One of the main benefits of a GEIS is that there is some generic information and conclusions that would be useful to RGU's and proposers so that they do not have to keep going back to collect the same information again and again. This document in its current form leaves an RGU or project proposer with little or no assistance when this document could, with improvements and more focused conclusions, greatly assist future decision making and policy development.

B. Categorized and prioritized recommendations. In addition to more focused conclusions, the recommendations provided in the Final GEIS should be categorized and prioritized. There seem to be categories of recommendations - some require federal action, some require state action, and some require local action. For instance, while some changes are needed at the federal level, the implementation plan could direct state agencies to draft the needed correspondence to encourage federal action. This can be done even in times of budget shortfalls. If action is needed by a specific agency, the agency is able to review its resources and consider priority shifts to meet the needs. Failure to categorize and prioritize recommendations will likely result in a scattered approach to addressing the issues raised in the Final GEIS and continue to leave animal agriculture and the citizens of Minnesota with significant uncertainty about what is needed in the future.

C. Issues other than just environmental regulations merit recognition. Finally the draft Final GEIS is written in a manner which implies that environmental regulations are the major concern of animal agriculture in Minnesota. This is not only an oversimplification of the issues but is not supported by the technical work papers. Not only does the draft Final GEIS ignore the growth of animal agriculture in states and countries with strong environmental regulations, but more significantly it ignores the significant roles economic development, social values (small vs. large feedlots), aging infrastructure, and research and technological developments have on animal agriculture independent of environmental regulations

5. Conclusions

We believe the above issues are the most serious problems with the draft Final GEIS from an RGU's perspective. We hope that the Final GEIS will be a useful tool to focus project-specific environmental review documents more narrowly. In its current form, the draft Final GEIS fails to do this.

Having received the draft Final GEIS less than two weeks ago, the MPCA is providing its overarching concerns now, with some examples to illustrate the problems that need to be corrected. We are hopeful that the meeting on Monday will help address our concerns and we intend to use what we learn in providing final comments on the draft Final GEIS by January 2, 2002. My staff are prepared to meet with EQB staff regarding the changes that are needed to the draft Final GEIS to ensure that MPCA comments are addressed. Myrna Halbach of my staff, is the MPCA contact for follow up, and she can be reached at 320-214-3794.

An adequate GEIS is important to Minnesota's agricultural economy and its environment. Without making sure the Final GEIS links to the Scoping Document and provides conclusions and determinations on broad animal agriculture issues, it will be difficult to reach a conclusion on adequacy. We strongly encourage steps be taken to address our concerns, and likely the concerns of other reviewers, before bringing the draft Final GEIS forward for a determination on adequacy.

Sincerely,

Karen A. Studders Commissioner
cc: Environmental Quality Board Members

MPCA Citizens' Board Members
Citizen Advisory Committee Members

MINNESOTA DEPARTMENT OF HEALTH
Protecting, maintaining and improving the health of all Minnesotans

December 10, 2001

Mr. Gene Hugoson, Chair
Environmental Quality Board
658 Cedar Street, Room 300
St. Paul, Minnesota 55155

Re: Generic Environmental Impact Statement on Animal Agriculture

Dear Commissioner Hugoson:

The Minnesota Department of Health (MDH) has reviewed the proposed final draft of the Generic Environmental Impact Statement (GEIS) for Animal Agriculture, dated November 26, 2001. We have also reviewed and contributed to the many documents produced during the process. I have been impressed with the amount of data collected and the information that has been compiled. The combination of the technical work papers and the final report will provide those interested in animal agriculture with a tremendous resource for further analysis. I commend the members of the Citizen Advisory Committee, Environmental Quality Board staff, and the agency staff who assisted, for their hard work over many months.

While I am impressed with what has been produced, I must also admit that I am not convinced the final product will live up to people's expectations of the GEIS. Despite the considerable amount of material, it has not been formatted and coordinated into a consistent, useful whole. My main concern is that the final draft report does not connect the scoping document to the recommendations. The EQB staff have made significant progress in working the scoping questions into the text of the final report. However, it is still difficult to identify which recommendations relate to which scoping questions. In addition, the recommendations appear to need further consolidation. Recommendations repeat themselves not only within categories, but across categories. A clarification of which actions must be taken at the federal, state, or local level is also necessary.

Given these concerns, I would appreciate if the board would consider the following actions as a way to make the final products of this effort more "user-friendly":

1. The individual chapters of the draft report have largely been reformatted to include the questions asked in the scoping document. It would be helpful if the recommendations that pertain to each question were also included. This will clarify the basis for each of the recommendations.

2. The recommendations should be separated into those directed at the state, the federal government and other entities.

3. Recommendations requiring state action should be prioritized. It should be noted that many recommendations are overlapping and their sequential implementation would be necessary.

4. Each recommendation should include a brief description of what would be needed to implement that recommendation. It should also be noted whether a recommendation could be accomplished with current funding or if additional funding would be needed.

5. Before staff undertake these activities, it would be helpful if the EQB provided our individual agency perspectives on priorities. From the MDH's perspective, the "Recommendations on Human Health" are obvious priorities. To illustrate the kind of format and discussion that would be helpful, we have attached our suggestions on priority recommendations for state action. I want to emphasize to the EQB that our recommendations highlight our human health mission and concerns.
We believe that taking our recommended actions regarding the draft report will enable the EQB to determine whether it is adequate. There are clearly other recommendations, such as those that deal with more creative zoning, better conflict management, strengthening the state-local partnership, and the recognition of the importance of agriculture to our state's economy, that should not be ignored. Indeed, achieving the goals of human health protection will not be possible unless the complexities of agriculture as an industry and a way of life are considered.

I look forward to a lively discussion as we work through our consideration of this GEIS.

Sincerely,

Jan Malcolm, Commissioner

cc: EQB members
CAC members
CHS administrators
Local Environmental Health Directors

Prioritization of Human Health related Recommendations from the Generic Environmental Impact Statement (GEIS) for Animal Agriculture

Highest Priority Recommendation for Human Health:

Recommendation #7 Human health concerns exist without regard to the size of a feedlot operation or species of animal being raised. Therefore, all feedlots and food animal operations need to comply with the regulatory programs that protect human health. State financial resources will be necessary both for the permitting/enforcement agencies and for the implementation of appropriate safeguards by farmers.

Supporting Discussion:

Information presented in the Water Quality Technical Work Paper demonstrates that more of our water quality problems, particularly nitrate and phosphorus, are associated with the storage and land application of manure from small and medium-sized farms than from the large feedlots that require a permit to operate. On the larger farms, fewer problems are associated with manure storage than with land application. Existing regulatory programs have not adequately collected and managed data on facility operations to be able to assess compliance with Best Management Practices (BMPs) or even the adequacy of existing BMPs as tools to protect water resources.

Actions needed to implement this recommendation:

1. Examine regulatory differences related to facility size. Request legislative action where necessary.

2. Establish BMPs (as part of a manure management plan) for land applications of manure and commercial fertilizer to protect drinking water supplies. This is essentially the intent of Recommendations #10, 27, 31 and 32.

3. One of the functions of the regulatory program is to assure compliance. Recommendation #39 is absolutely essential both for the regulatory program integrity and for public acceptance.

Recommendation #39
County and state feedlot inspection programs should include monitoring for compliance with nutrient management plans and with other land application requirements.

It must be accompanied by the will and the ability to take appropriate enforcement when compliance is not forthcoming. (Recommendations 8, 14, 29, 44, 55, 56, 57.)

4. Consideration should be given to exploring animal density limits or some other mechanism to monitor regional acreage claimed for manure applications. This will ensure that the carrying capacity of the land, as defined by the soils, geology, and hydrology, is not exceeded. This is partially addressed in Recommendation 42.

Second Highest Priority Recommendation for Human Health: Recommendation #4.

We support research to characterize health effects, quantify source strength, and determine the environmental fate of outputs of animal agriculture that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research.

Supporting discussion:

One of the areas deserving of research attention is the issue of odor. Odor problems have driven much of the discussion and conflict about animal agriculture. Odor issues have not been dealt with very effectively by any of the local or state regulatory processes.

Odor is not necessarily a public health problem because response to a smell is a highly personalized reaction. In terms of defining odor as a public health problem, we use hydrogen sulfide (H2S) as a surrogate for odor and compare field measurements of H2S to existing regulatory standards. When the regulatory standard is exceeded, we conclude that it is a public health problem.
This approach is necessitated by the fact that odors are complex; other chemicals and toxins in air emissions may well be contributing to odors but we do not have the means to measure them. Since we can't manage what we can't measure, we use H2S as a surrogate. Clearly this issue deserves research attention.

Until such time as we know more about the various chemicals that constitute emissions from animal agriculture (and their toxicities), it is highly desirable to implement the following action steps (with reference to recommendations) which will support both human health concerns and community concerns/conflicts about odor:

<u>Action Steps needed to Implement this Recommendation:</u>

1. Staff from appropriate agencies should develop a research agenda to address specific concerns about emissions and discharges from animal operations. Once a clear set of research needs is identified, the state should seek funding from a variety of sources to perform the research. The actual conduct of the research studies should be done by credible scientific groups. Research findings and appropriate control technologies should be incorporated into regulatory programs without delay.

Recommendation 17
Encourage/support the research and development and technology transfer of livestock air quality control technology.

2. The state should take the leadership role to implement Recommendation 14 to reform the odor complaint process.

Recommendation 14

Reform the odor complaint process to respond more expediently and require documented notification to the facility owner that a complaint has been received. Develop a central and accessible database to log complaints, responses, findings and resolution data, using objective testing tool with standardized protocols.

3. The state should expand the MPCA ambient Air Quality monitoring network to more fully characterize agricultural impact from feedlot operations (Recommendation 17, Ex. 3-2). Based upon the findings of research characterizing the outputs from agriculture, the air quality monitoring may need to incorporate additional chemicals. This will likely involve additional funding.

4. Inform our Congressional delegation and federal officials of the need for a national program regarding antibiotic resistance and animal agriculture. Ongoing Congressional debate on the new farm bill might provide the opportunity to press for such a program.

5. Coordinate existing informational materials to develop a low cost web site to provide greater information to the public and producers about the public health implications associated with disease occurrence, disease transmission, and antibiotic resistance from animal agriculture.

Third Highest Priority Recommendation for Human Health: Identify Funding for Improvements at Small and Mid-Size Feedlots.

If we agree that small and medium farms are contributing to emissions and discharges that have human health and environmental impacts, then we need to assure that state and federal funding programs help these producers implement the practices that are needed to control emissions and discharges. Recommendation 24 would make the costs incurred to comply with certain land application practices eligible for cost share funding. Recommendation 40 asks the legislature to fully fund cost-share needs and Recommendation 62 states that we need to increase funding and information on programs that specifically help small and mid-size producers fulfill their environmental stewardship responsibilities. If the small to mid-size producers don't have the economic ability to implement the policies and practices recommended in the GEIS, we will not make any progress toward ensuring sustainable agriculture. While the new, large facilities seem to receive the most scrutiny, both from a regulatory and community perspective, their compliance with regulatory standards should be considered a cost of doing business just as it is with other large, industrial facilities.

Action Steps needed to implement funding recommendations:

1. Inform congressional delegation of the need for targeted funding and use the GEIS information to support that request. Ongoing Congressional debate on the new farm bill provides the opportunity to press for targeted funding.

2. Prepare appropriate legislative initiatives in the next biennial budget to target resources. This should be done by appropriate state agencies.

3. Consider ways of recognizing those producers (small, mid-size, and large ones) who take extra steps to comply with recommendations from GEIS. The certification programs mentioned in Recommendations 11, 23, and 68 could be fashioned to achieve this recognition.

MN COACT Mission Statement
"To educate and organize people to empower themselves and take action in the democratic process."

Minnesota COACT
2233 University Ave. Suite 300
St. Paul, MN 56345
651-641-0027

December 10, 2001

Minnesota Environmental Quality Board
658 Cedar Street
St. Paul, MN 55155

Re: Public Hearing on proposed Final GEIS on Animal Apiculture

Ladies and Gentlemen on the Environmental Quality Board:

While we would have preferred to submit public comment to this Board today, MN COACT has not had the opportunity to review the proposed Final GEIS. Again, we are unable to access the MN Planning site to download the document.

Before we submitted our final recommendations on the Public Review Draft GEIS we reviewed the entire document. It would be an injustice to the CAC [Citizens Advisory Committee] and the staff at MN Planning if we did not review the proposed Final GEIS as carefully.

MN COACT was privileged to be part of the Waterkeepers presentation in Northfield on December 7th to hear Mr. Robert Kennedy Jr. and Mr. Rick Dove present information about the devastation to the local economy and the environment from large-scale confinement agriculture, One of the slides they presented showed that family farmers produced 60 million hogs in 1915; the total production in 2000 was 59 million with most of the current operations controlled by a few corporations. Obviously, we don't need large confinement operations to produce food for consumers. In fact, there has been a significant increase in the consumer population without a proportionate increase in demand unless we are importing.

We have found the Public Review Draft GEIS and TWP's [technical working papers] to be a valuable resource in our work to support and protect independent family farmers, along with their families and communities. We will be diligent in reviewing the proposed Final Draft and will make our recommendations before the final written comment date of January 2, 2002.

Respectfully submitted,

MN COACT

Mr. Don Pylkkonen, Executive Director

MINNESOTA INDEPENDENT CROP CONSULTANTS ASSOCIATION

MNICCA

December 31, 2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

RE: Comments on the Generic Environmental Impact Statement on Animal Agriculture.

The following comments are being submitted on behalf of the Minnesota Independent Crop Consultants Association (MNICCA). MNICCA, the professional organization representing independent crop consultants in Minnesota, is a group of trained professionals consulting in the fields of agricultural and environmental sciences. Members provide crop production recommendations and contract research services to farmers and agribusiness's in Minnesota. All of our members are certified. Crop consultants use detailed knowledge of their clients farm management history, as well as, soil test results, economics and environmental considerations to make site specific, field specific and farm specific recommendations for plant nutrients and other crop production inputs.

The Minnesota Independent Crop Consultants Association (MNICCA) has reviewed parts of the final GEIS document and are disturbed by the statements and connotation made by the authors of the Technical Work Paper (TWP) on Water Quality and the resulting recommendations of the Citizens Advisory Committee (CAC) that are based on this document. There are numerous points of contention; however, because of time and other constraints, only some of the more significant points will be addressed in MNICCA's written comments.

The authors show a clear bias to implicating present-day agricultural practices of fertilizer and manure management as significant causes of water quality degradation. They accomplished this by making invalid assumptions, using improper methodology and selectively referencing the literature. The results are recommendations that are not based on proven **cause and effect** relationships. The effect of implementing recommendations that are not based on proven cause and effect relationships is wasted public and private monies and possible increased water quality degradation.

In scoping question #8 the authors imply that fertilizer and manure nitrogen is the primary cause of hypoxia in the Gulf of Mexico. The authors did not site any research or studies that prove a cause and effect relationship. In the early 1990's, some researchers showed a correlation between the flux of nitrogen from the Mississippi River and the size of the hypoxia zone in the Gulf of Mexico. Since that time, this correlation has not held up and a cause and effect relationship has not been proven. This perception should not be propagated without adequate scientific evidence to support it. A few people's beliefs are not scientific evidence of a cause and effect relationship.
The author's also indicate that 5% of the Mississippi River nitrogen flux comes from the Minnesota River basin. The literature sited shows that it is approximately 3% and not the 5% that was indicated.

The Water Quality TWP was referenced in answering scoping question #10 of the GEIS document as to the various sources of N and P loadings to the Minnesota River. The various sources sited did not include native and/or background sources of N and P. It is a serious fault in the methodology to not include native and/or background sources in the calculations. The failure to include these sources leads to erroneous conclusions. The Burkart & James reference in the Water Quality literature review section indicated that only about 40% of the agricultural nitrate sources in the Mississippi River Basin are from inorganic fertilizer and manure. Soil organic matter mineralization was considered to be the largest source in this study. By using the Burkart & James reference for background sources of nitrogen, the percentage loading estimate from manure and commercial fertilizer to the Minnesota River would be reduced to under 40%, rather than the 81% that is sited. The 40% is still likely to be a significantly high estimate, because the soils in the Minnesota River Basin have some of the highest organic matter levels for the Mississippi

River Basin. The authors 2% legume contribution is grossly underestimating legumes. Soybeans are known to fix 120-150 lbs./acre/year of nitrogen and there are almost as many acres of soybeans as there are corn in the Minnesota River basin.

Similar to nitrogen, the authors of the Water Quality TWP failed to account for native or background loadings of Phosphorus (P) in answering scoping question #10. The authors made no attempt to determine either background or native loading estimates, even though significant research has been done to establish these estimates. Estimates, from various references, for **native** areal loadings for the prairie ecosystems, range from 0.1 to 0.67 lbs./acre/year. Estimates, for **background** areal loadings of P for the agricultural ecosystems of the basin are in a similar range. A simple mathematical calculation, would establish that background or native P loadings, can account for virtually all of the P in the Minnesota River, which is not attributable to an identifiable point source. Therefore, the efforts in the Water Quality TWP to proportionate manure and fertilizer P contributions to the rivers of Minnesota are based on invalid methodology. The Ginting & Moncrief references in the Water Quality literature review actually document a significant reduction in Phosphorus runoff when manure is applied to fields.

However, a more important issue with Phosphorus is to determine the proportionate contribution of the various sources of P under low flow years for rivers, such as, the Minnesota River. Phosphorus is a concern in surface waters only to the extent that it will stimulate algae and weed growth, which consumes oxygen when it dies and decomposes. Low dissolved oxygen levels can impact fish survival. It is a well-established fact that this, Phosphorus linked, condition only occurs in the Minnesota River in low flow years. MPCA and Met Council monitoring have clearly documented this fact in the 1994 MRAP Report. Therefore, efforts to identify sources of Phosphorus for anything but low flow conditions are irrelevant and misleading.

The primary sources of Phosphorus, under low flow conditions of the Minnesota River, are city wastewater treatment plant discharges. In 1988, the last time the Minnesota River had a significant problem with low dissolved oxygen in the lower portion of the river, the 1994 MRAP report documented that 65 % of the total Phosphorus load came from the 5 largest wastewater treatment plants that discharge into the river. The other 35% came from the remaining 120+ smaller city wastewater treatment plants that discharge into the rivers and streams of the basin, along with septic systems and other nonpoint sources. It is logical to assume that very little P is coming off the landscape in low flow years, because of the lack of rainfall to cause runoff. Therefore, it is reasonable to conclude that P coming off the landscape and moving into rivers and streams that feed into the Minnesota River is not a water quality concern. This is probably true for other major watersheds, also.

MNICCA questions the methodology and assumptions used to determine the *Excess Nutrients Applied to Land from Manure and Fertilizer* on page vi of the Water Quality TWP executive summary. The Water Quality TWP determined that nitrogen was applied to land at excess rates of 19 lbs./acre and phosphorus was applied at excess rates of 35 lbs./acre of P_2O_5. It was indicated that University of Minnesota recommendations were used as the reference rates. The University of Minnesota fertilizer guidelines require site-specific, field-specific and farm-specific management information, such as, soil tests and cropping history. No documentation was provided in the TWP to show that the 18 county study area was characterized in this manner. Instead, a county wide number was estimated by one individual soil fertility professor. MNICCA has numerous members with equal or superior qualifications to make fertilizer recommendations and all feel the approach used by the authors is totally without merit.

There can be a big difference between a recommendation based on an average and the average of all recommendations. A simple analogy would explain the flaw in the logic used by the authors of the Water Quality TWP. Averages can be made up of numbers that are tightly and uniformly distributed around the mean **or** with extremes that are skewed in one direction. An example of the first is 10 numbers with an average of 20 and a range of 15-25. An example of the second is 10 numbers with an average of 20, however 9 of the numbers are in the range of 10, while one is at 110. The first example is what the authors assumed in their calculations. The second example is more the reality of the agricultural landscape and should have been the method used.

It is the speculation of MNICCA members that the second and more appropriate methodology would show that Nitrogen and Phosphorus are not being applied excessively based on the University of Minnesota recommendations. In reality, especially in the case of Phosphorus, Nitrogen and Phosphorus are probably being under applied.

Another concern that MNICCA has with the author's methodology is how they define **excessive**, when discussing nutrients applied to the land. *Excessive* relative to water quality can be significantly different than *excessive* relative to profitability or some other point of reference. On page G-11 of the literature review it was noted that Minnesota research shows that about 200 lbs./acre of available nitrogen can be applied for soybeans '*without incurring environmental risk*.' There were no rates of nitrogen listed for corn; however, because corn is a high nitrogen demanding crop, it would be reasonable to believe that rates nearly equal to the soybean rate could be applied without incurring environmental risk. The average nitrogen use rate for corn, of about 139 lbs./acre in the TWP 18 county study area, therefore, should not be considered excessive, based on environmental criteria.

Rates of nitrogen that are based on profitability need to be developed on a site-specific, field-specific and farm specific basis. The authors of the study did not do this. Development of a nitrogen rate by any other means would go contrary to the very concept of profitability. University of Minnesota nitrogen rate guidelines are assumed to be based on profitability and not water quality criteria. MNICCA believes the 120 lbs./acre nitrogen rate used by the authors in the study an arbitrary number and should be discarded.

MNICCA believes that sustainability of productivity should have been a consideration by the authors of the Water Quality TWP. Especially so for a plant nutrient like Phosphorus, which is generally recognized to be a major limiting factor for crop production in southern and western Minnesota. Long term studies by University researchers show that 50 lbs./acre/year of P_2O_5 is needed to maintain soil test levels in the optimum range. These studies were referenced in the literature review for the Water Quality TWP. A simple calculation can be used to determine if this rate is being exceeded in the study area used by the authors. If the total annual pounds of P_2O_5 from manure and fertilizer is divided by the cropped acres in the study area, an average rate of approximately 47 lbs./acre/year is derived. This number clearly indicates that Phosphorus is not being used excessively.

Common sense should also be considered when discussing fertilizer and manure rates used by farmers. The farm economy has been depressed for the last 15-20 years. Manure and fertilizer are costly and valuable commodities. Farmers that do not efficiently utilize these commodities will not be in business very long.

MNICCA believes that the CAC recommendations for the implementation of a P-index is inappropriate because it has not been developed for Minnesota. At this time there is no basis to suggest it would have any impact on improving water quality. The P-index is a theoretical concept that has not been developed or field tested. In fact at the 2000 American Society of Agronomy annual meeting in Minneapolis, Dr. Jerry Lemunjon of the NRCS apologized for being one of those who dreamed up the concept. He publicly dreaded the day someone would advance the P-index concept into a regulatory tool. He said it could not be done with any level of accuracy.

A P-index would need to be site-specific and involve highly complicated and easily debated measurements involving slope, transport distances, source, application timing, weather events, sensitivity of receiving water body, etc. The recommendation, for implementing something that has not been developed and is theoretical at best, needs to be questioned. MNICCA requests that all CAC recommendations that refer to a P-Index be discarded because they are without merit.

MNICCA cautions against developing policies or regulations for water quality that are not based on **well-established cause and effect relationships**. The effect of such policies and regulations may be more than just a well-intentioned failure. The effect of implementing such policies and regulations could result in severe negative economic impact on farmers and business, wasted public and private monies, and possible increased water quality degradation. A reference, in the Water Quality literature review, documents an example of this failure. Garrison & Asplund studied the effects of reducing phosphorus loadings on a Wisconsin lake at the mouth of a 3003 acre watershed. Practices were implemented that reduced Phosphorus losses in the watershed from animal waste storage facilities by 46% and cropland runoff by 19%. Fifteen years after implementation of the practices, total phosphorus levels in the lake increased from 29 to 44 ppb.

One of several things can logically be construed from the above study. One, there was no cause and effect linkage between total phosphorus loadings from the landscape and lake phosphorus concentration. Two, some other factor was responsible for the higher concentrations, possibly in-lake recycling or point sources. Or, three, the implemented practices somehow resulted in the higher concentrations. Possibly bio-available phosphorus was more important than total phosphorus and the implemented practices resulted in higher bio-available phosphorus. Whatever the reason, a failure occurred in establishing the proper cause and effect relationship to begin with. This type of situation needs to be avoided.

MNICCA believes there are serious problems with the methodology, assumptions and conclusions of the Water Quality TWP and that these problems would have been caught and corrected if an independent peer review was done prior to submission of the document. It is our recommendation that the Water Quality Technical Working Paper be sent back to the authors for independent peer review and correction of the problems. Proper scientific standards for a study like this would dictate that the authors would have an independent peer review done before submission of the final document. It is MNICCA's understanding that an independent peer review was not done.

MNICCA requests that all recommendations based on the Water Quality TWP be discarded until the document is updated and independently peer reviewed. These include CAC recommendation numbers 24, 25, 27, 32, 34, 36, 37, 39, 41, 42 and 43. The points that were discussed in this comment letter should be considered in updating the document. In addition, as a matter of good public policy, authors of any part of the GEIS document should not receive or benefit from research grants that result from recommendations in the document.

MNICCA thanks the EQB for consideration of our comments. If there are any questions contact Steven Sodeman at 507-639-6441 or Steven Commerford at 507-359-4429.

Sincerely,

MNICCA Board of Directors
Steven Sodeman, President Steven Commerford, Past President

George:

Following are some additional comments on the proposed Final GEIS on Animal Agriculture.
These are public comments, subject to EQB responses as required by MN Rules 4410.2700 Subp. 1.

Insertion of Language from Gene Hugoson Letter
In the introduction (paragraphs 5 and 6), you have chosen to insert language taken verbatim from a letter to you from Gene Hugoson, Commissioner of Agriculture, dated October 25, 2001. This language makes assertions that not only do not appear in the GEIS, its Technical Work Papers, or its Literature Review, but which are in direct conflict with findings from these sources. Pursuant to MN Rules 4410.2700, Mr. Hugoson's assertions should be included in the EQB's response to comments (they are not), and responded to in consideration of the actual content of the GEIS. As the language in question is wholly unsubstantiated, and, again, in conflict with the findings of the GEIS, I am confident that EQB's reasoned response will be to remove it from the introduction.

Language Stricken Regarding Farm Operation by Full Owner
In the "Description of Animal Agriculture," "General Changes in Agriculture" section, language regarding the decline in the proportion of farms operated by the full owner has been stricken. No explanation for this is provided in the Response to Comments section, nor is a comment suggesting it be stricken presented there.
Substantiation for this deletion should be provided, or the language should be re-instated.

Comment On Number of CAFOs With NPDES Permits Lacks EQB Response
The "Role of Government" chapter, section on "EPA Regulations Under the Federal Clean Water Act," contains a discussion of NPDES permitting for CAFOs, noting that "many CAFOs in Minnesota are still not permitted. By previous correspondence, MCEA commented that only 25 of 808, or 3 percent, of CAFOs in Minnesota have been issued an NPDES permit. The EQB has chosen not to included this information, and has also not responded to the comment as required.

Comment on Conflicts Between State Legislation and Federal Law
In the "Role of Government" chapter, section entitled "Observations on the MPCA Feedlot Program Under the Revised Rules," legislation enacted in 2000 which is in direct conflict with federal law is mentioned, though the conflict is not. Three provisions are in such conflict: 1) The prohibition on MPCA enforcing state rules unless

public subsidy is available (this one is mentioned as being in the legislation, but not as being in conflict with federal law); 2) Less restrictive numbers for calculating "animal units" than are contained in the Code of Federal Regulations (this one was included in the CAC-reviewed draft and dropped without explanation from the final draft); and 3) The prohibition on the MPCA placing conditions in NPDES permits that are not specifically spelled out in state rule or law or are not agreed to by the permittee (this one was included along with the other two in previous MCEA comments, but has not received an EQB response). The EPA is currently deciding whether to request amendment of the 2000 legislation or to impose restrictions on MPCA's delegation of authority to administer the NPDES permitting program for CAFOs. It is hard to believe that this subject does not merit inclusion in the GEIS (it is discussed in the Role of Government Technical Work Paper).

MPCA Failure to Conduct Mandatory EAWs
Important language was dropped in the proposed final GEIS (without showing up as stricken) from the CAC-reviewed draft. Formerly contained in the "Role of Government" chapter, section entitled "Minnesota Environmental Review Program," it stated: "The MPCA reports that 16 feedlots of 2000 AU or greater received permits in 2000 and 35 feedlots of 1000-1999 AU received permits. However, only 5 EAWs were completed during that year." This is important because completion of an EAW is mandatory under EQB rules for feedlots of 1000+ AU. EQB's attempt to delete this finding of a stunning failure of duty by the MPCA is dishonest and unfair to the public. This language should be re-instated immediately, or an explanation of new facts contradicting those in the earlier draft included.

Unsubstantiated Perceptions on Environmental Review
The proposed final GEIS contains new language in the "Role of Government" chapter, final paragraph of the section on "Observations on the Effectiveness of Environmental Review." The language was added in response to comment #75 (Appendix B - Summary of Public Comments and EQB Staff Responses). The comment asserts "The GEIS fails to discuss the current misuse of the environmental review process as a harassment tool to raise the overall costs of a feedlot project to discourage its completion..." EQB's response, included in the GEIS states "Some feedlot producers perceive that Environmental Review is sometimes used by feedlot opponents as a weapon to stall or stop feedlot proposals, or to harass producers. Oftentimes, the producers believe that the alleged environmental effects cited by the opponents are imagined or exaggerated, serving merely as an excuse to bog the project down in an EAW or EIS process, and the real motives of the opponents have nothing to do with environmental concerns."

EQB's new language is entirely unsubstantiated, and in fact is roundly contradicted by the actual GEIS findings discussed immediately above it, notably that 1) an EIS has never been prepared for a feedlot; 2) a mere 1.2 percent of new facilities have undergone preparation of an EAW; and 3) the value of publicly raised issues in finding mitigation solutions.

"Benefits" of Drainage Language Added
New language has been added following the CAC-reviewed draft in the "Water Quality" chapter, "Surface Water" section about how farmers "must have these drainage systems in order to produce crops in their
land. The positive economic benefits of agricultural land drainage in Minnesota have been significant." These assertions may or may not be true, but they are not derived from the GEIS study findings, are not substantiated, are not related to impacts on surface water quality and should be deleted if not properly explained and substantiated.

Impacts of Hormones on Surface Water Quality Deleted
The "Water Quality" chapter "Surface Water" section contained a paragraph on the effects of hormones on surface waters in the CAC-reviewed draft. (The study found that soil and runoff concentrations of the potent sex hormones estradiol and testosterone increased with poultry litter applications.) This language has been deleted and is not shown as stricken in the final draft. The language should be reinstated.

Assertions on Impacts of Air Emissions Modeling Added
New language has been inserted in the "Air Quality and Odor" chapter, section titled "Use of Air Dispersion Models in Environmental Review of Feedlots." Several claims are made: 1) The high cost of air dispersion modeling (GEIS found that this cost is now quite reasonable); 2) Emission factors in use are not adequately tested and sound (no such finding appears in the Technical Work Paper or prior GEIS drafts); and 3) Modeling may be perceived as hampering feedlot expansion in Minnesota (no such findings in earlier GEIS drafts or TWP, contrary findings in Role of Government). Delete this language or substantiate it with facts.

A appreciate the opportunity to comment again on the GEIS and look forward to EQB's responses.

Sincerely,

Kris Sigford
MCEA Water Quality Director
CAC Member

Mr. Johnson: A hard copy of our statement with the attachments was mailed to you December 31st. We tried to tailor our comments to issues that can be accomplished within the upcoming session or through immediate agency action. We compliment you and your staff for compiling a very useable and informative reference document. We hope the EQB and the Legislature recognize your efforts. Stan Estes and June Varner

"Minnesota COACT (Citizens Organized ACting Together) is a grassroots membership governed organization, working to build community in the quest for social and economic justice. We educate and organize people to empower themselves and take action in the democratic process."

December 28, 2001

Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

Attn: George Johnson

The most pragmatic reasons for government regulation of the agricultural sector involve the fundamental need to protect national security and public health through the provision of a reliable supply of food and fiber. We must protect our natural resources for future generations and because this is the only way of ensuring the ability of our independent farmers to remain in business to provide our food supply. Clearly the emphasis of the GEIS recommendations places environmental and health priorities first.

The GEIS established that the best way to maintain and improve the overall carrying capacity of Minnesota agricultural soils is to add the organic matter in manure to improve soil structure and tilth. Organic farms, which generally utilize manure rather than commercial fertilizer, have a higher soil quality compared to conventional farms. Sustainable and organic producers also generally report a higher per unit profitability and a better quality of life. (1.Primus and Scherping economic information) This makes it clear that any state educational programs and funding should be directed to those operations that are willing to make the transition to these systems. Producers that are already using these practices and/or those they select should be the paid educators for the people who want to learn and use them.

The following are the MN COACT Recommendations based on information in the Proposed Final GEIS on Animal Agriculture, Technical Working Papers and supplemental supporting documents.

1.The moratorium on lagoons should be expanded to include all feedlots. Allow existing feedlots to use liquid storage if they are reducing their animal units so their manure production capacity does not exceed agronomic rates for land spreading within one mile, based on a GIS coordinated nutrient management plan. Page 31 #77. The CAC recommends a continued moratorium on the construction of new open-air swine basins, except existing facilities may use basins of less than 1 million gallons capacity as part of a permitted waste treatment program for resolving a pollution problem or to allow conversion to a different animal type, provided all standards are met. Page 152 With liquid or semi liquid sources (especially if nutrient concentrations are low) the transportation costs become prohibitive at distances greater than about one mile.

2.The State of Minnesota should prohibit the use of antibiotics except to treat disease and disseminate information on probiotics. Page 81 The most promising area for reducing the rate of development of microbial resistance to antimicrobials is in the use of competitive bacteria added to feed to promote the growth of normal bacteria and exclude pathogenic bacteria in food animals. These agents, called probiotics, will most likely see a significant increase in use over the next ten years, and may replace some of the nutritional uses of antimicrobial agents.

3.The State must at least measure (not model) Hydrogen Sulfide and Ammonia downwind from feedlot facilities, and enforce health limits based on childrens' health risks. (2. Email U.S. Hog January 16, 2001 Children, brain damage, hydrogen sulfide exposure) Page 109 Odors and dust from feedlot operations are causing a serious health threat to many individuals. This comment is supported by the results of the Air Quality technical workpaper and the concerns are reflected in the GEIS document. The area of odors, air quality and related health effects is one of CAC priorities for additional research and regulatory funding. Page 174 Research shows that nasal irritation can elevate adrenaline, which can convert mild annoyance to irritability, tension, and anger.

4.MPCA should hire a full time GIS staff person. Page 237 The MPCA does not have a fulltime GIS staff person to work on the feedlot inventory database. Because LMIC is non -partial and has worked with all of the counties over the past three years as part of the GEIS, they should work with the MPCA to merge county feedlot information into a digital database. Recommendation: Have the Strategic Office of Long Range Planning, Land Management Information Center work with the Minnesota Pollution Control Agency and the Department of Agriculture to develop a statewide feedlot inventory database that is usable at both the county and state level.

5.The State should enact animal welfare rules based on the decision statement. Page 191 The decision by society and/or by individuals to use animals (labor, recreation, etc.) and to consume the products they produce (meat, milk, eggs, etc.) requires steps to ensure that the health and well-being of these animals is adequate and consistent with societal norms and expectations. In order to achieve and maintain these norms, society needs to have an understanding of where and how their food sources are produced, have an active involvement in the process, and intervene if and when necessary. Adopting more natural alternatives to current practices is one way of preventing and mitigating negative effects on animal heath and well-being. These alternatives should be consistent with social goals for animal agriculture such as public health, food quality and safety, humane ethics, and environmental quality.

6.Considering the indictments of officials involved in feedlot permitting, the state should establish a Board for local appeal with oversight and audit responsibilities for feedlot officers and establish standards for community dialogue in a setting that will allow expression of one's opinion in a manner that will be respected. Page 214. Comment #70 State should develop an oversight mechanism to assure that feedlot regulators do their jobs properly and to which the public can appeal without the expense of court; this authority would audit work of County Feedlot Officers. Page 48 Opportunity for community dialogue, such as the chance to express one's opinion about a community concern with the sense that it will be respected, is also key to the presence of strong social capital.

7.Amend MERA [Minnesota Environmental Rights Act] to allow direct citizen action on feedlots. Page 96 Another potential avenue of public redress against polluting feedlots would normally be the Minnesota Environmental Rights Act (MERA), which gives citizens the right to bring civil actions to protect the air, water, and other natural resources from "pollution, impairment, and destruction." However, by excluding "family farms," "family farm corporations," and "bona fide farmer corporations" from the statute's definition of "person," MERA effectively excludes feedlots from direct citizen action.

8.Develop nutrient management plans for operations that use manure with the ultimate goal to setup nutrient management plans for all cropland. Nutrients applied in excess of agronomic rates violate RECRA. (3. Press Release Waterkeepers Alliance, Northfield, MN December 7th) Page 67 Farming practices that violate state or federal laws, such as water pollution from feedlot run-off, are grounds for lawsuits by non-farm neighbors. (As well as farmer neighbors.)

9.Use and enforce the existing biosolids heavy metal standards for manure. Page 170 Many metal-containing compounds are added to animal feed, often in the form of antimicrobials to improve animal health. Most of these metals are essential nutrients that can be toxic at high concentrations. A non-nutrient metal, arsenic, is common in poultry diets. These metals are excreted in manure and could potentially pose a risk to human health if they are transported in excessive amounts to surface water or groundwater from manure-amended soils. In addition, some metals are known to bioaccumulate in fish which is a significant health risk for those who rely on native fisheries as a significant portion of their protein.

10.Agricultural families need State help to ensure insurance coverage so that working off farm is an option rather than economic necessity because they cannot afford health insurance. Page 33 Farm operators across the State are increasingly engaged in off-farm employment, implying that farming is increasingly becoming a more part-time occupation. (4. Farm Forum 12/07/01 Page 3F Insurance, one reason for working off farm.)

11. Enforce property rights - feedlot pollutants and effluents cannot leave the site. Page 96 The cost of ligitation is prohibitive for individuals. Property rights in the legal sense means that you cannot use your land in a way that diminishes or injures the use and enjoyment of your neighbors property or of the public property. (5.Exerpt from Video of Waterkeepers Alliance, Northfield, MN December 7th speaker - Robert Kennedy, Jr.)

12.Include consumer and-non industry representation proportionately in the Stakeholders Feedlot Air Emissions Data Collection Project. Page 143 This is an ongoing project begun in 1999 by a collaborative agreement of the MPCA, Minnesota Department of Agriculture, University of Minnesota, Minnesota Pork Producers Association, Minnesota Milk Producers Association, and Land O' Lakes Corporation (the "stakeholders").

13.The Attorney Generals Office must establish a clear and credible line of enforcement for feedlot regulations and violations that includes the contractor in a contract operation, and require disclosure of the contractor for all current and future permits relating to feedlots issued at a state or local level. Page 90 As part of any implementation program, a credible threat of enforcement is important to protect the environment from the small percentage of people who will not comply with the law except for this threat, to ensure that regulations are taken seriously, and to ensure fairness and a level economic playing field. A good inspection program is a prerequisite to a sound enforcement program.

14. Eliminate direct and indirect subsidies to feedlots and industry operatives. (6.Farm Forum 12/07/01 Page 1, Pork group cashes in on livestock odor rules) Many companies have already put a monetary figure on their environmental liability, i.e. Externalities. (7.Ground Water Vol.38, No2. March-April 2000 Page 161, Environmental Accounting: The New Bottom Line) Page 113 External costs and benefits, typically called "externalities" in economics, are impacts felt by people who are not party to a particular decision or transaction. For example, a farm has internalized costs (purchases of inputs) and when it sells its product there are internalized benefits (from the market transaction), but along the way there are external costs (e.g., effluent that is not paid for) and external benefits (contributing to an appreciated way of life). In economics, externalities are one of several "market failures," imperfections in the market that prevent "invisible hand" forces from leading to maximum welfare.

Respectfully Submitted in behalf of MN COACT,

Stanley Estes and June Varner,

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Incl: 1.Primus and Scherping economic information
2.Email U.S. Hog January 16, 2001 Children, brain damage, hydrogen sulfide exposure
3.Press release Waterkeepers Alliance, Northfield, MN December 7th
4.Farm Forum 12/07/01 Page 3F Insurance, one reason for working off farm.
5.Video Transcript, Waterkeepers Alliance, Northfield, MN December 7th speaker - Robert Kennedy, Jr.
6.Farm Forum 12/07/01 page 1, Pork group cashes in on livestock odor rules
7.Ground Water Vol.38, No2. March-April 2000 Page 161, Environmental Accounting: The New Bottom

Attachment #5

Robert Kennedy Jr. Exerpt from a video tape of the Waterkeepers Alliance in Northfield, MN on December 7, 2001. Minutes 1:56:44 to 1:58:47

"The irony is that a lot of these Corporations that come in here and talk about property rights; they say we have the right to do what we want on our property. But, here is what the law says, we and the environmental groups, we don't care what anybody does on their own property; every American private property rights are very important to our country. Nobody complains, and, the law doesn't regulate how you use your private property, but you cannot use your property in a way that diminishes or injures the use and enjoyment of your neighbors property, or of the public property, which we own, the waters and the streams.

When you take ownership of a parcel you don't take ownership of the right to create nuisances on your parcel of land. And, what they are doing is, they are using their property to destroy the value of the neighbors property; they are harming his property rights. What we are doing is fighting for property rights; we want to defend the rights of public property, and we want to defend the rights of private property owners whose livelihood and lives, and the use and enjoyment of their properties, are being absolutely destroyed by these facilities.

That is what Rick's (Dove) film also talked about what's happening to the waterways of North Carolina; it is choked, carpeted with blooms of fillamentis [sp?] algae that kill the fish and rob the water of its oxygen. The groundwater in these facilities is contaminated almost invariably, in almost anyplace it is tested it has large amounts of nitrogen, which as you know, causes blue baby syndrome, and all kinds of problems, like with carrying pregnancies to term, and child development. So, they are stealing something that belongs to the public; which is the aquifers, something that belongs to you and me."

To the Environmental Quality Board:

I feel it is important to put a moratorium on all expansions of animal agriculture in this state of Minnesota. It is a mistake to let anymore factory farms move in and further pollute our waters, air and soils.

We have many problems with what we already have, and these problems need to be addressed.

Modern day farms/factory farms are the evil in our time. They are the demise of the family farms. Examples from other states, factory farms do pollute the waters, the air and the soils. Their use of antibiotics have created the "super bugs" that the AMA has warned that this practice must be stopped, because of the antibiotic resistant bacteria now identified, and that the antibiotics of ten years ago are no longer effective. Stronger and stronger antibiotics are having to be developed to fight the "superbugs." The growth hormones given to these animals are responsible for many of the cancers, in both men and women. Girls are developing at a much earlier age. More reproductive problems are noticed in humans and wildlife. Foods from these factory farms are needed to be irradiated to be safe for humans to eat.

These alarms are revealed to us now at this stage of the factory farm takeover game, and what will the future show us? More alarms. The state of Minnesota with it's 10,000+ lakes needs to be protected. This is a tourist state, a recreational state. We all need to do our part in protecting what is not only ours but what also belongs to our children and our future generations. All of us own the air, and the waters, and no one farm operation or other industry has the right to destroy or harm what belongs to the rest of us. The Mississippi River starts in this state and where I live, Rice, the water is polluted. We are warned not to eat the fish out of the river. And to realize that as the water flows south, it becomes even more polluted. The Gulf of Mexico has it's 7,000+ acres of dead zone because of our carelessness in protecting the environment.

All liquid manure lagoons, earthen basin pits need to be banned. Composted manure practices would be the ideal way of handling manure on existing farms. And soil testing should be done by an independent agency, not anyone connected to the farm or to the county environmental services department. Berms need to be established or farther setback distances , along with immediate incorporation of manure, are needed to protect all waterways, and wetlands whether it is "protected" or not.

Robert Kennedy Jr., at the WaterKeepers meeting last month, said that the law clearly states that you can do whatever you want on your own land as long as it does not diminish quality of life or the enjoyment of your neighbor on his own land. So, if that is what the law is, why are we having all of these neighbor conflicts? And why are county's permitting these barns and increase in animal units? They already know what the problems are that the neighbor's and the environment will suffer. These people need to be accountable for
their actions.

In this county, I have witnessed and experienced the changing of the laws and ordinances to protect the confined animal operation that is 750 feet from our home, less than 300 feet from our property line, and less than 300 feet from our City's boundary line. The ordinances were changed without consulting with the City, and these ordinances were put in place originally to protect the City. I feel that it is important that the county not be allowed to issue conditional use permits for expansions of farming operations within the setback requirements without consulting with the City. In our City, we are planning for municipal services and massive growth. According to a survey sent out last year, our citizens responded and it is showing that 600 acres will be developed within the next 5 years. Intergovernment relations are necessary.

State agencies and local agencies need to do their jobs in protecting the health, safety and welfare of the people and the environment. That job belongs to each of us. We all need to respect the environment. It is a gift from God.

Respectfully submitted,

Karen Peternell
8219 County Road 131
Rice, MN. 56367

REMARKS ON PUBLIC COMMENTS: Helen Palmer 11/6/01

No member of the public called for the downfall of animal agriculture in Minnesota. The need to keep the economy strong was not in question. It was more common to read a statement like "Animal agriculture is vital to our state." What I heard and read over and over, however, is public concern for a kind of animal agriculture which would foster health for people and animals and which would protect and even enhance Minnesota's air, water, soil.

After having read and digested all the written comments, the summaries of the oral comments and having attended three hearings myself, I wish to say that I object very strongly to attempts to set up an opposition between, on the one hand, a good economy, and on the other hand, healthy people, animals and environment . These kinds of attempts are facile and simplistic and, overwhelmingly, do not represent the public view.

The public recognized, rightly, that the CAC failed to do a real comparison between the various types of production systems, that we did not pay serious attention to' "alternative" systems such as rotational grazing. The public also recognized the lack of attention to cumulative effects of animal agriculture (we were to give this "particular emphasis") as well as to externalities. And many saw, to their dismay, that we side-stepped the CAC objective of emphasizing sustainability. Many wished to remedy this—through more support (assistance, incentives) for small and mid-sized producers, non-intensive production methods, education in alternative systems, etc.

What was remarkable in the public comments was the lack of enthusiasm for, and in many cases, sharp animosity to large-scale, often called "corporate" or "industrial" agriculture. One person referred to owners of industrial operations as "tyrants." As another put it, "We are heading for Wal-mart agriculture and nobody wants it." There was a lot of comment about the bias of the CAC (its composition) which was seen to be promoting the agenda of "big" agriculture. Clearly, there is still a big problem of mistrust.

The remarkable public response to the issues of animal welfare and subtherapeutic antibiotic use shows how tremendously important and timely these issues are. As some pointed out, it was a serious mistake not to have had on the CAC at least one member who was an expert animal health/welfare. The evidence could not be clearer that the public is learning about animal issues in agriculture, and they know that the subject can no longer be trivialized. As one writer said, "callous disregard for the well being of farm animals will eventually swell into a major public issue" (#89).

To: George Johnson
From: Helen Palmer
November 5 2001

George: I realize you put together the Animal Health/Well Being chapter of the GEIS in a hurry, so much so that it didn't get finished in time to be distributed to and discussed by the CAC before going out in draft form to the public.

I would like to see some changes made in it, not because there's anything wrong with what is there, but because I think some good material from both the lit summary and the

TWP need to be included. So, the following is intended to provide some substance for readers who may not get to the background materials themselves. Obviously it all comes from the two sources, the Uof M and M. Halverson. For your own information I have identified the sources as Crooker and Halverson, but I wouldn't expect such info to be in the document.

I am only too aware of how dicey this whole topic has been and therefore how tricky this chapter is. When you wrote it you tried to grapple with the animal welfare issue by discussing the difficulties of the topic at some length. I would suggest that in this case less is better than more. I would leave out the discussion of the trickiness of the issue and get as much hard content out of both Crooker and Halverson as possible (not the least because Crooker is all over the map on the issue, contradicting himself). To make it easier for the reader, I moved much of what you said about animal welfare up to the beginning.

I have tried to keep to the facts presented by both Halverson and Crooker, eliminating lines that don't tell us much—like "most producers feel that…" or prescriptive statements about how things ought to change.
This chapter is the kind of thing a person could work on forever, trying to reconcile two different views of the world, basically. I'm really not trying to do that kind of reconciliation, but just to get into the document some useful information which in your haste you didn't put in before. It should be relatively easy to adjust the document with these alterations/additions.

Animal Health/Well-Being chapter—changes suggested by Helen Palmer Nov 5 2001
I think the chapter could well begin with a passage from Crooker (I would move it from the bottom of page 182 where you now have it):

The decision by society and/or by individuals to use animals (labor, recreation, etc.) and to consume the products they produce (meat, milk, eggs, etc.) requires steps to ensure that the health and well-being of these animals is adequate and consistent with societal norms and expectations. In order to achieve and maintain these norms, society needs to have an understanding of where and how their food sources are produced, have an active involvement in the process, and intervene if and when necessary.

Then go to GEIS page 175 *as follows, incorporating part of the second paragraph. When you mention Marlene Halverson you should also mention that she had an international team of experts as advisors:*

The material in this chapter… and current research topics. The TWP
looks at many of the same topics but from a different perspective, that of animal welfare. It was produced by Marlene Halverson…systems.

I would drop the rest of page 175, as I don't think it is needed. I would go on to set up an explanation of the difference between the animal welfare and the industrial

perspectives in agriculture. I have moved the following paragraph from where you had it—you had it on p. 185. It incorporates pretty much what you included on the topic but somewhat differently. It's from Halverson.

Contemporary agricultural practices and veterinary health objectives focus on maintaining and enhancing animal performance, placing primary importance on the function served by the animal in the agricultural system rather than on its state. Welfare, on the other hand deals with state of the animal as regards its attempts to cope with its environment. The emphasis of animal welfare science is on health and well-being for the animal's sake, from the perspective of the animal.

Most of the modern concerns about the welfare of farm animals stem from the impacts on animals of economic and technology choices in industrialized forms of agriculture, wherein animals are treated as if they were organic machines rather than sentient beings. When the animal's function alone is emphasized, the imbalance has important effects, not only on farm animal welfare, but on the environment and human health. It also has economic effects: this year the European Union is committed to bringing farm animal welfare to the World Trade Organization (WTO), strengthened in its commitment by the devastating social, animal welfare, and economic effect of this spring's foot and mouth disease epidemic.

A vast scientific literature on farm animal welfare has developed since at least the 1960s, with ethology (study of animal behavior) being one of the leading disciplines. A major event in this development was the 1965 report of the Brambell Committee, a group of zoologists assigned by the British government to look into 'the welfare of animals kept under intensive livestock husbandry systems'. This committee recommended that production systems should allow animals at least these five basic freedoms:
to turn around;
to groom themselves;
to get up
to lie down; and
to stretch their limbs.

More recently the UK's Farm Animal Welfare Council (a government body) stated animal welfare needs in terms of five freedoms which included
freedom from thirst, hunger, and malnutrition;
freedom from discomfort
freedom from pain, injury, and disease;
freedom to express normal behavior
freedom from fear and distress.

Animal welfare concerns arise at four stages in animal production: pre-production (issues of domestication and genetic selection), production system; when the animal goes to slaughter (is it fit or is it crippled, injured or weak? Injured or subjected to prolonged fear, pain and suffering during transport?); and at the slaughter plant (line speeds in modern beef packing plants can be up to 400 animals an hour and in modern pork packing plants up to 1000 animals per hour, risking both animal and human well-being.) I would then move straight to Study Question 1. Under Study Question 1 I believe (and one commenter said so too) that we need some basic information about rules and regulations. After your first paragraph, p. 176, I suggest inserting the following (it is essentially all from Crooker):"

The "Animal Welfare Act" is the federal government's principal law protecting the welfare and well-being of animals; however, animals raised for food or fiber are specifically excluded from the Animal Welfare Act. Federal law has a fairly large number of statutes and regulations relating to the use of drugs on the animals, transport, marketing, and sale of food and fiber animals. The Humane Methods of Livestock Slaughter Act of 1958 calls for humane slaughtering and handling of livestock in connection with slaughter. Congress has not, however, extended the requirement of humane treatment to these same animals while they are being raised on the farm. Federal tax law has implications for animals too. The live animals on the farm are considered no differently than crops. The animals can be depreciated, and capital gains and losses are applied to them. The animals on the farm are another business commodity, much like cars, paper, steel or any other business product." Federal law is also involved in marketing: under the auspices of the US Department of Agriculture the marketing of many species (e.g, sheep, pork) is promoted.

Go to your second paragraph, p. 176, but after the sentence ending "or slaughter houses," add: **The Board employs three inspectors to enforce the statute and its rules. These three inspectors are assigned to cover 36,000 cattle farms, 11,000 hog farms, 3,000 sheep farms, 650 turkey farms, and 350 chicken farms—a total of approximately 1.2 to 2 million Minnesota animals. Minnesota also has an animal cruelty statute, which covers all animals in the state. However the statute provides weak penalties for violations, no matter how severe.**

Then add: **Finally, Minnesota has no law requiring producers to have downed animals euthanized on the farm rather than send them to slaughter or requiring transport, stockyard or cull facility workers to euthanize them immediately if they are injured during transport. There is no law or government agency protecting the welfare of ill, injured, or incapacitated animals.** *I would end this section there.*

There is so much overlap with the remaining study questions that I recommend grouping all the answers to all the remaining ones, following the order of categories a,b,c,d,e listed on page 176. In what follows I have used, obviously, both Crooker and Halverson. In the interest of simplification and so as not to make the chapter too long, I have eliminated the discussion of the philosophy of animal well being vs. productivity etc. I would start this section out with:

ANTIBIOTIC USE ***(In this section I combined Halverson and Crooker)***

The public, and especially those in medicine, are concerned with increasing resistance in bacteria that are relevant in human diseases. An overwhelming body of evidence exists indicating that the livestock industry's continued, routine use of antibiotic feed additives at subtherapeutic levels contributes to antibiotic resistance (World Health Organization 1997). These concerns have contributed to a growing discussion by the public and by scientists about food production practices

In Sweden such use of antibiotics was banned in 1985. While the poultry and cattle industries made comparatively smooth transitions, on many piglet-producing farms, withdrawal of antibiotics from the feeds unmasked disease pressures that low-level antibiotic feed additives had kept "hidden." As a result, Swedish farmers who were having problems changed facilities and management to provide a higher level of welfare to the animals than before (allotment of space, use of straw, weaning age). Today, total antibiotic use for food animals in Sweden is 55% lower than before the ban, the incidence of antibiotic resistant bacteria has been reduced, animal health is very high, and production levels are close to pre-ban levels.

DISEASE AND SICKNESS ***(from Crooker)***

Two vices, which appear common across all domestic poultry, are feather pecking and cannibalism. Feather pecking has been associated with cage systems but can be observed regardless of housing condition. Significant losses due to cannibalism can occur in confinement as well as alternative systems such as free range. Mortality loss can be severe. Beak trimming is used to reduce both vices. In swine behavioral problems include stereotypic behaviors, cannibalism and aggression between contemporary animals. Stereotypic behaviors are activities performed by pigs that seem to serve no useful purpose to the animal. Most often these behaviors are associated with pregnant sows housed in confinement systems. Cannibalism is most often expressed as tail biting and ear biting…and is more prevalent in confinement systems compared with extensive systems. The widespread practice of docking tails in confinement systems seems to be the most effective management practice to control tail biting.

Many different kinds of parasites affect agricultural animals in North America: skin-inhabiting ectoparasites, free living flies, and internal parasites. Generally regarded as threats to animal health and well-being, these parasites produced quite varied effects. Free-ranging animals are exposed to the greatest variety of parasites, whereas animals that are confined in dry lots or indoors are exposed to progressively fewer kinds. Many individual farms have routine parasite monitoring and control programs, but there are no systematic reporting systems for any of Minnesota's animal industries.

Bovine Spongiform Encephalopathy (BSE or mad-cow disease) is a transmissible, slow progressing, fatal nervous disorder of adult cattle. It is characterized by the formation of holes in the nerve cells and results in a chronic degeneration of the brain. The disease became an epidemic in the UK. From April 995 to April 1999, some 176,433 cases of BSE were confirmed in the UK. Implementation of a number of measures reduced new cases dramatically. These measures included a prohibition in 1988 of the use of rendered by-products derived from ruminants as a feed for ruminants in the UK. No cases of BSE have been detected in the U.S. The federal government restricts importation of live ruminants and ruminant products from countries where BSE is known to exist, and import restrictions have been imposed on other products derived from ruminants.

INDOOR CONFINEMENT AND ANIMAL DENSITY

I would begin with your section on confinement systems (which you have under Study question #3, pp. 181-183). I would keep all of that except the last paragraph (p. 182) which I had already moved up to the beginning of the document. So, after your last complete paragraph, ending with "Large-scale production….income," I would add information from Halverson (and some from Crooker) on welfare problems stemming from intensive systems, as follows:

From the animal welfare standpoint, two management factors are especially important to consider– degree of confinement and intensity of production.

Some examples: About 99% of hens producing table eggs in the U.S. are being kept in battery cages (rows of cages side by side and stacked on top of each other in "batteries." These hens are thus unable to perch, dust-bathe. build a nest, etc Welfare problems of this system include osteoporosis, muscle weakness, bone breakage—conditions which are likely to cause severe and prolonged pain and suffering, and can be especially critical during transport. Additional welfare problems include starvation of force-molted laying hens (a practice that extends hens' productive lives by stimulating a second laying cycle), foot deformities and surgical procedures such as beak trimming. Spent hens, broiler lameness are other welfare problems. Some European countries have increased the minimum space allowance for laying hens and others have banned battery cages altogether.

As with meat chickens, the welfare of turkeys is a matter of concern due to often high densities of birds in turkey houses and the selection for rapid growth by breeding companies. As with broilers, pigs, and dairy cattle, breeding for larger size and performance in turkeys has occurred at the expense of good bone growth or structure.

Major welfare problems of dairy cattle include mastitis, foot and leg problems, reduced fertility, inability to show natural behavior, emergency physiological responses that consume energy needed for maintenance, and injury. Other welfare issues with cattle include dehorning and calf housing, and the issue of surplus calves. While countries in the European Union have developed legislation covering the welfare of calves during transport and Canada has developed recommended codes of practice, protection of calves in the US is limited.

Housing is a pig welfare issue. On most industrialized pig breeding farms, boars and sows are housed permanently in crates. Whereas individual crate housing of boars also used to be common practice in Europe, today it is forbidden. In January, 2001, a new EU directive was proposed which would require sows to be housed in groups rather than individually in crates or tethers and would require that pigs have materials for rooting. Today, gestation stall sow housing predominates in the US hog industry. Osteoporosis in crate-housed sows is a pressing welfare issue (contributing to the downer sow problem in the industry). Premature sow mortality is a significant and growing problem in the US swine industry. Estimates range from 10% to 20% of sows on intensive confinement operations dying while still in production.

Alternative systems exist—for example, at the University of Minnesota an alternative swine systems program has been created and will be investigating pasture farrowing, deep-bedded hoop housing, and a version of a model of deep-bedded group farrowing and lactation developed in Sweden. Research directed toward solving the problems of producers trying to adopt alternative systems is a central aim of the Minnesota program. Further, a welfare-compatible production method for dairy cows known as intensive rotational grazing has gained favor among a segment of Minnesota dairy farmers.

AIR QUALITY IN CONFINEMENT FACILITIES ***This is essentially from Crooker.***
Air quality within animal facilities depends on many factors including the ventilating system and air exchange rate, temperature, relative humidity, manure system and management, bedding use, feed form and quality, feeding system, and animal activity. Airborne particulate or dust is considered to be a health risk for workers exposed over a long period of time. Although there are no data available to demonstrate specific effects on dust on the health of pigs, cattle, or poultry…it is known that dusty environments are associated with decreased health. Animals housed in intensive production systems (essentially housed indoors) such as those commonly found in Minnesota, are exposed to a number of different atmospheric gases at levels that are higher than those found outdoors. Hydrogen Sulfide and ammonia have received the most attention. As with the human safety concern when manure in pits or tanks is agitated and pumped onto cropland, the sudden death of housed animals in these confined barns has been reported. A few of these occur each year in Minnesota. Airborne endotoxins, microbes, and pathogens are other airborne contaminants that may pose a health risk to animals housed inside buildings.

USE OF PROCESSED MANURE AS FEED ***(all from Crooker)***
Animal wastes have been recycled as feed for cattle, swine, and poultry. Most of the waste used for animal feed is from confined systems. Animal wastes are a good source of protein and fiber, however, recycled animal wastes for feed have the potential of exposing animals to pathogenic organisms, toxigenic molds, parasites, harmful levels of pesticides, medicinal drugs, and high concentrations of trace minerals and heavy metals. In 1980 the FDA left the regulation of feeding animal wastes to individual states.

DISEASE PREVENTION AND MITIGATION MEASURES ***(from Crooker)***

Exposure to bacterial and viral pathogens occurs frequently in the life of an animal, and can spread laterally throughout animal populations at a rapid rate. There are many disease-control strategies, such as all in-all out animal flow and segregated early weaning for swine, vaccination and early separation of calf from dam in cattle, immunization and medication for poultry. Preventive medication is usually provided in the feed the use of feed medication is strictly controlled by the FDA. Strategies for controlling airborne contaminants in confinement facilities include, for example, oil sprinkling for dust, ventilation control and air cleaning. Human exposure is controlled by limiting the time people are exposed to airborne contaminants and having people wear appropriate personal protection. (BC 107-119

I would end the chapter with a paragraph made up of Crooker's and your words but gathered from different sections. First, from p. 175:

Animal health and well being are the foundation of any humane, sustainable livestock production system. Producers must ensure the management practices they use are appropriate for the species, the type of production system, and the environment. Much of what is known has been determined through years of hard work, research and refinement. Then add your words from last paragraph, p. 185, but eliminating the first sentence:

Decisions on animal welfare issues….respond accordingly.

January 2, 2002

To: Minnesota Planning
Animal Agriculture GEIS
658 Cedar Street, Room 300
St. Paul, MN 55155

Re: Comments on GEIS Technical Work Paper – Impacts of Animal Agriculture on Water Quality

From: Dan Schmitz, Agronomist, Christensen Family Farms

Following are concerns surrounding the nutrient budget used to determine "excessive" nutrient applications in the selected study area of the GEIS Technical Work Paper – Impacts of Animal Agriculture on Water Quality.
While constructing the nutrient budget used to evaluate the use of Nitrogen and P2O5 in the selected study area, the authors of the Technical Work Paper – Impacts of Animal Agriculture on Water Quality (TWP) failed to consider a number of factors important to sustainable and profitable crop production. The methods used to determine and conclude that applications of Nitrogen and phosphorous are in excess of crop needs and therefore a threat to water quality were poor and contradicted information in the literature review, research the authors themselves had conducted in the past and information presented in the TWP itself. The conclusions of the Technical Work Paper on Water Quality and the implied impact of production agriculture on water quality were unsubstantiated.

In considering the use of nitrogen the authors neglected to consider the wide range of soil types and crops grown in the study area. In making the average nitrogen recommendations no consideration was given to the variability that exists in the landscape and the impact that variability has on crop response to nitrogen. Changes in organic matter and drainage have a significant impact on yield, yet these attributes where neither characterized between counties or within counties. The texture and organic matter level of the soils in Todd, Morrison and Stearns County very considerably from that of Martin and Blue Earth as an example. Nitrogen recommendations by their very nature need to be "site specific" given the dynamic nature of nitrogen in the environment. To attempt to create a nitrogen budget without first characterizing the soils is poor methodology.

The impact of spatial variability on the response of corn to nitrogen was demonstrated by Malzer. In a study conducted in south central Minnesota at four sites over two years, optimum fertilizer N rates ranged from 0-180 lbs/acre. The average optimum N rates at the four sites were 89, 142,138, and 168 lb N/acre. The nitrogen recommendations offered for the nutrient budget in the TWP would have been, on average, below optimum at three of four sites.

When determining the amount of N applied in excess of the recommended rates for corn, no consideration was given to the amount of nitrogen fertilizer and manure applied to and consumed by soybeans and other legumes. Legumes are compensatory and will utilize available nitrogen before manufacturing nitrogen. In the TWP the MDA FANMAP data was referenced and showed that from 17% to 33% of manure was applied to soybeans or alfalfa. According to Table 20 of the TWP 194,398 tons of nitrogen from manure and fertilizer was applied in the study area. If we assume at the minimum 17% of this was applied to soybeans or alfalfa, only 161,350 tons was available for application to corn. This is 3,176 tons less than the total recommended fertilizer nitrogen for corn put forth by the TWP. There is also a fraction of fertilizer nitrogen applied to legumes when DAP or MAP is used as a phosphorous source that is not removed from the "excess" equation. It is important to note that in the literature summary for the GEIS on page G-13 we read, "Application of manure for disposal purposes to soybeans, alfalfa, and grass has been extensively studied in Minnesota. Manure can be applied following corn harvest for soybean at rates totaling about 200 lb available N/acre without incurring environmental risk."

The phosphorous budget put forth in the TWP on Water Quality is inadequate. No attempt is made to characterize actual loss mechanisms from the various soils in the study area. The implication that any P2O5 application above 40 or 50 lb/acre every two years is a threat to water quality is unsubstantiated. To make such an implication is irresponsible for sound phosphorous management and profitable and sustainable crop production. On page 95 of the TWP on Water Quality the authors state, "Estimating the exact fraction of excess P2O5 transported to surface water is difficult. Factors that influence P transport include climate, landscape, proximity of land to waterbodies, cropping system and crop yields, soil P levels, amount and timing of excess P applied to the soil, method of application, and conservation practices."
Without any attempt to characterize these factors for the study area in the TWP the reader of the TWP is left to believe that any application above the authors per acre budget is destined for degrading water quality.

Using 40-50 lb/acre of P2O5 as a per acre budget for a corn-soybean rotation is problematic from both an environmental and profitable crop production perspective. Research conducted by Randall at Waseca, Lamberton and Morris evaluating changes in soil test P (STP) show that it takes 40-50 lb P205/acre *annually* to maintain STP at 20 ppm. In the proceedings for the 1996 Soils and Fertilizer Short course, Randall concluded that economic return (to applied phosphorous) was greatest when 150 lb of P2O5 was applied every third year. These rates are twice the amount of P2O5 used in the budget for the study area. Applications lower than 50 lb P2O5 per acre annually on soils with 20 ppm of STP or less is not sustainable and could limit long-term productivity of soils.

In Technical Bulletin 2001-1 from the Phosphate and Potash Institute (PPI), *Soil Test Levels In North America*, Minnesota is shown to have 60 % of the soil tests reported with less than 20 ppm of Bray P and 47% of the samples fall into the medium category or lower. For a corn-soybean rotation, University of Minnesota recommendations range from 0-210 lb/acre of P2O5 depending on the expected yield and soil test level for phosphorous. By considering amounts of phosphorous needed to maintain sustainable and profitable crop production and phosphorous recommendations for soils in the low and medium categories, 40-50 lb of P205/acre every other year is not a realistic budget for phosphorous.

The capacity of the soils and the crops grown to assimilate phosphorous was not considered in nutrient budget for the TWP. A summary of yields and crops grown in 1997 in the study area show that 119,733 tons of P2O5 was assimilated and removed by crops. This was calculated from the 1998 Minnesota Agricultural Statistics Bulletin and crop removal data from the University of Minnesota. Table 20 in the TWP shows that a total of 116,956 tons of P2O5 from manure and fertilizer was applied. Evaluating a phosphorous budget based on crop removal would show a deficit of 2,777 tons of P205 in the study area. The NRCS has also studied the capacity of cropland and pastureland to assimilate nutrients and shows similar findings for the counties in the study area.

The conclusions that in the seventeen counties studied there are excessive applications of Nitrogen and Phosphorous from fertilizer and manure applications has not been substantiated by the TWP on Water Quality. By considering N used by legumes, sustainable P205 applications, University of Minnesota fertilizer recommendations and the assimilative capacity of cropland to use nutrients, the nutrient budget for the study area takes a much different shape with opposite conclusions. The authors conclude that 19 lb N/acre and 35 lb P2O5/acre were applied in excess of crop needs. When considering sustainable and profitable crop production, a deficit of 7 lb/acre for nitrogen and 2 lb/acre for phosphorous exists in the study area.

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January 2, 2001

From: Diane Halverson, Farm Animal Advisor, Animal Welfare Institute, Washington, D.C., c/o 402 Washington Street, Northfield, MN 55057

To: Mr. George E. Johnson, Project Manager - Animal Agriculture GEIS, Minnesota Planning - Environmental Quality Board, 658 Cedar Street, Room 300,
St.Paul, MN 55155

Dear George,

Attached please find the Animal Welfare Institute's comments on the Draft Final GEIS on Animal Agriculture in Minnesota, Farm Animal Health and Well-being. We are reiterating concerns outlined in our most recent comments, due to the fact that pressing issues were not addressed in the Draft Final GEIS.

We have a window of opportunity, long awaited by compassionate citizens and desperately needed by the animals languishing inside animal factories, to do something meaningful in Minnesota. Please do not waste the substantive Technical Working Paper on Farm Animal Health and Well-being by Marlene Halverson and the team of international expert scientists she assembled. Please do not gloss over the truth about the impact of 25 years of industrializing the raising of sentient creatures. The animals cannot organize and cannot lobby. It is up to us whether they continue to suffer or not.

Respectfully submitted by:

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Comments on GEIS on Animal Agriculture in Minnesota
Submitted by Diane Halverson, Farm Animal Advisor, Animal Welfare Institute,
and by Northfield-area citizens
January 2, 2001

We wish to express appreciation to the Citizens Advisory Committee for recognizing the importance of addressing the topic of farm animal health and well-being in a scientific and comprehensive way. We appreciate the fact that farm animal health and well-being is recognized in the Executive Summary as an important theme. We must also express our concern and disappointment that the current GEIS draft relies heavily on the University of Minnesota Literature Summary in its discussion of animal well-being, primarily reproducing its rhetoric, and in doing so does not reflect the current substantive scientific knowledge on this subject. On the other hand, the Technical Working Paper on Animal Health and Well-Being draws on the expertise of seven internationally recognized animal welfare scientists, highly respected in their professions, three of which are located at North American universities. These were David Fraser, professor and Industrial Research Chair in Animal Welfare, University of British Columbia; Ruth Newberry, Professor of Animal Welfare, Washington State University, and Joy Mench, Professor of Animal Science and Director of the Center for Animal Welfare at the University of California, Davis. Dr. Mench also sits on the McDonalds Corporation Animal Welfare Advisory Council and I serve with Dr. Mench on that McDonalds Council.

There were also 4 internationally recognized scientists from Europe who provided scientific expertise for the Technical Working Paper. We urge that the final GEIS draft represent the current state of scientific knowledge on farm animal health and well-being, as described in the Technical Working Paper on the subject.

<u>Page 175, paragraph two</u> of the State's report provides scant information about the Technical Working Paper (TWP). The TWP is a 324-page document by Marlene

Halverson which draws on the expertise of seven internationally recognized animal welfare scientists. The public deserves to have these facts about the TWP laid out in the second paragraph of the State's chapter on "Animal Health and Well-being".

This paragraph also needs to mention that the author, Marlene Halverson, was advised in this work by a team of scientists so that the TWP is not mistakenly perceived as the work of only one person.

<u>Page 175 paragraph 3</u> refers to ballot initiatives in Denmark, the UK and Sweden. To our knowledge there are no "ballot initiatives" in these countries. Nor are there similar laws in Illinois and Florida at this time. There is legislation introduced in Illinois and a ballot initiative pending in Florida.

<u>Page 175 paragraph 4</u>. We would add the following underlined material: "Producers must ensure the management practices they use are appropriate for the species, the type of production system, and the environment <u>*and for the public health*</u>."

<u>Page 175 paragraph 5</u> states that "Animal research has greatly enhanced the efficiency of producing animal products." This is not generally true, since "animal research" of the last 30 years has focused on facilitating the adoption of highly <u>*inefficient*</u> animal rearing systems, for example, fossil fuel-intensive, antibiotic-dependent, pollution-producing intensive animal production systems that externalize many of the real costs onto other people and the environment, wasting precious antibiotics, wasting water and fossil fuels.

<u>Page 176 Study Question 1</u>: The TWP on Animal Health and Well-Being should be referred to here. This TWP has substantial sections on regulations and routine practices in Minnesota, the United States and Europe related to the health and well-being of animals used for food. See Chapter 9, "Mitigation Measures: Animal Welfare Regulations in the U.S., with Special Reference to Farm Animal Protection in Minnesota" and Chapter 10, "Mitigating Measures: Regulations and Routine Practices in Minnesota and Other Places That Are Aimed at the Health and Well-Being of Animals".

<u>Page 177 Study Question 2, paragraphs 1-4.</u> These paragraphs rely heavily on the rhetoric typically used to mollify the public.

This section contains gross exaggerations and generalizations, including this statement in <u>paragraph 1</u>: "Caretakers of animals used to produce food and non-food products for human consumption are sensitive to the health and safety needs of their animals". The TWP documents that this statement is far from accurate in today's industrialized systems which depend on untrained, unskilled hired labor operating systems that are highly dependent on the widespread use of antibiotics to maintain growth and mask disease among animals who, without the drug use, would succumb from ill-health to disease or poor "performance". The consequences of ill-health are actually covered over rather than "apparent to the producer" as the paragraph claims.

It is incorrect to state that: "Economic necessity encourages them to manage their animals to prevent many health problems from occurring". For example, routine use of antibiotics allows caretakers to maintain growth and productivity in pigs even when animals are unhealthy and suffering, and bovine growth hormone increases many health problems in dairy cattle, yet there are dairy farmers who claim the hormone is a necessity to achieve satisfactory economic returns.

Paragraph 2 states that the "definition of well-being is more nebulous for both humans and other animals". The TWP provides a non-nebulous definition and *extensive* analysis of animal well-being. See TWP Chapters 1-3 for discussion of well-being and Chapters 5, 6 and 7 for discussions of well-being by species.

Paragraph 3 states: "Most agricultural animal scientists believe an acceptable level of well-being is achieved in the majority of the production systems on American farms."

This statement incorrectly assumes and suggests that agricultural animal scientists are the only scientists whose opinion matters and that they are authorities on the subject of animal well-being. However, it is *animal welfare* scientists whose beliefs and expectations are of critical importance when we talk of animal well-being, and these scientists do *not* believe an acceptable level of well-being is achieved in the industrial farming systems that dominate U.S. agriculture. The TWP documents an appalling lack of animal husbandry knowledge and lack of interest in or ability to recognize factors that affect animal comfort and normal behavior.

Page 177, paragraphs 3 and 4 refers to only two polls of American consumer attitudes about farm animal welfare. The polls referred to in TWP Chapter 8, page 186 are completely ignored. They should also be covered here.

Page 177, paragraph 5. The TWP page 12 explains in its first three lines that the animal ***must be able to adapt without suffering*** to these environments or environmental range. This is a key point that needs to be added. Further, it is inaccurate to generalize that animal well-being is the "ultimate goal of farm animal use strategies". Minnesota, and the U.S. in general, contain countless examples of operations where animal well-being is not the goal or a product of any strategy. These are documented in the TWP.

Page 178, paragraph 1. The TWP is once again ignored. As documented in the TWP, it is not accurate to say that a "considerable lack of consensus remains among various individuals attempting to assess the well-being of agricultural animals." The specific issue of consensus is examined in the TWP pages 13-14. In conclusion, the TWP states that that "...The similarities of the interpretations further support the position that consensus does exist, at least among animal welfare scientists, regarding the scientific definition and assessment of farm animal welfare." This is important, and the unscientific opinion that there is no consensus should not be stated as fact in the GEIS.

U.S. agricultural scientists have conducted few and very limited studies of the farm animal welfare issue, much of it shaped by an interest in protecting economic interests of intensive agriculture. These studies by no means reflect the entire body of scientific evidence used to assess animal well-being, and therefore there is no valid connection between sentences one and two in this short paragraph..

Page 178, paragraph 2: The TWP also contains discussion of animal agriculture production systems used in the United States to promote animal welfare, as well as systems used in Europe.

Page 178 paragraphs 3 and 4. While it is a sad fact that producers and their advisors often rely on easily measured traits --such as quantity of feed and water consumed-- as indicators of animal health and well-being, it needs to be pointed out that these are inadequate measures.

Social interactions among pen or herd mates do not only provide information about well-being in "extreme cases such as with livestock behavioral vices". Social behavior is a fundamental consideration in evaluating the well-being of all species raised for food in all cases.

"Maximizing food production" is often presented by industrial agriculture as the justification for their intensive concentrated practices, however, this suggests that agriculture cares nothing about profits and is simply on a humanitarian mission to feed the world. Nothing could be further from the truth. When large-scale industrial operators have "chosen to restrict certain natural animal behaviors" --for example, forcing sows to live in crates unable to walk or turn around over a period of years-- they do it not to maximize food production, but to maximize profits through high volume production overseen by unskilled, hired and cheap labor. Ignoring the profit motive only serves to further obfuscate the issue of farm animal well-being.

Page 178 paragraph 5, subhead Animal Well-Being- Beyond Health. This paragraph continues to "mystify" animal well-being and to mistakenly characterize the establishment of humane standards of husbandry as a strictly socio-political issue. It ignores the TWP's thoughtful discussion of how standards can be science-based, while appreciating that there will be social or moral pressures as well.

Page 179, paragraph 1. This paragraph seems to set the stage for application of a tactic used by proponents of industrial agriculture who seek to preserve the status quo: the argument that public opinion, values, and perceptions are always evolving and that producers therefore should not be expected to respond to public concerns about animal suffering in intensive agriculture because the public's expectations in this regard are ever-changing. However, Minnesotans expect moral behavior toward animals, including those raised and killed for food.

page 179, paragraph 2 states. "Most livestock producers feel that they are providing decent and humane treatment for their animals. They are as appalled as any member of the public at deliberate or unnecessary cruelty." This generalization cannot be documented. In fact, there is plenty of evidence to show otherwise, namely, the unspeakable practices that are widely employed by producers: continuous crating of sows preventing them from walking or turning; cramming laying hens in battery cages, or calves raised for white veal in crates unable to walk or turn, without solid food and an adequate diet. How can it be said they are as "appalled by any member of the public at deliberate or unnecessary cruelty", when surveys show that the overwhelming majority of the public opposes the very practices these livestock producers employ.

The paragraph states that "Most animal productivity measures are very likely to be positively related to animal welfare." However, if productivity is measured in terms of egg output per building, the productivity per building may be high, while the welfare of individual animals is very low. This paragraph also does not allow for or acknowledge that productivity is often maintained by the use of antibiotics which mask the animals' true state of health and welfare.

page 179, paragraph 3. It needs to be clarified that simple proxies that are easily quantified have clear advantages *for industrial producers, but not for animals***.**

The examples of practices in this paragraph do not adequately reflect the practices which the public considers cruel. At least one example of what is euphemistically referred to as "confined living space" needs to be included here, for example, continuously confining sows in crates, unable to walk or turn, for years.

page 179, paragraph 4. In the second sentence, an adequate example needs to be supplied, such as that of laying hens, crowded into battery crates that prohibit birds from basic needs such as spreading their wings, walking, dust bathing, grooming, perching, nesting and developing a species-specific social hierarchy.

Page 180, paragraph 1: To describe restriction of some aspects of animal behavior as "temporary" does not adequately reflect the fact that laying hens are permanently confined in battery cages, sows confined in crates for all of their breeding lives, etc. They are only temporary in the sense that the animal is slaughtered when she is removed from her battery cage or crate.

Page 180, Study Question 3

We find the first two paragraphs confusing.

The third paragraph states: "All livestock production systems strive to minimize any potential negative impacts of the system on the animal, the producer, the environment, and society while maximizing profitability." First, a production system is inanimate and cannot strive. More importantly, not all designers, builders and owners or operators of systems strive to minimize all of these potential negative impacts. If they did strive, they would not be failing so miserably, would not be causing real animal suffering, vile pollution, and destroy the culture of independent family farms, wreak havoc on public health, etc. Indeed, large-scale industrial systems can maximize profits because they are allowed to externalize the full costs of their production onto the environment, the animal and society, including small farmers who are being pushed out of the marketplace by high-volume producers.

Page 181, paragraph 2 suggests that everything is on the upswing for animals going to slaughter, that the future will bring sure improvements in loading, transport and slaughter. The reasons for this optimistic view are not laid out however. The Animal Welfare Institute's knowledge of abusive transport situations and on-going violations of the Federal Humane Slaughter Act nationwide, and the examples of documented abuse in Minnesota discussed in TWP Chapter 9, pages 202-203 and 205-206, make clear that this paragraph in the GEIS describes a future hope and is not accurately depicting the current reality.

Page 182, paragraph 4. It needs to be said that large-scale production units have *lead to* slim margins, because overproduction lowers prices. Large-scale production units, particularly vertically integrated companies, compensate for slim margins not only with "increased output", but by driving down prices to points so low that only companies with deep pockets can withstand the losses, while less well-heeled, smaller farmers, succumb to low prices and/or to lost markets.

Page 184, paragraph 1. It is unclear *who* found it "relatively easy to summarize available preventative and mitigative measures...etc." and *when or in what document* they did so.

The TWP contains ample evidence that, contrary to the second sentence of this paragraph, the industry *does not* respond "quickly to address aspects that are detrimental to animal health performance". To state only that "Considerable less is known relative to the cognitive aspects of animals well-being" implies that this field is a deep mystery, which is an incorrect.

Page 184, paragraphs 3 and 4 and page 185 paragraphs 1 through 4 provide essential fundamentals on the topic of animal health and well-being. It would be very helpful to have these explanatory paragraphs placed early in the document rather than at the very end of the document where they seem to be an afterthought. They would serve readers if placed early in the document, providing readers with basic, necessary information to understand the entire discussion of animal health and well-being.

Page 186, "Recommendations for Animal Welfare Research" is confusing. For example, it appears to be suggesting that despite the in-depth discussion presented in the TWP, more research is still needed before the State of Minnesota can "move" on this issue. The purpose of the GEIS was to provide was to provide a scientific basis for determining how to move on the issue of animal health and well-being. The TWP provides this scientific basis.

The TWP is not a "brief" discussion - it is an extensive, 324-page substantive discussion. Not only the Animal Welfare Institute describes the TWP this way. The swine newsletter authored by Professor John Deen at the University of Minnesota Animal Sciences Department described the TWP as "substantive". While no report can reflect the volumes of research on this subject, the TWP is a formidable and useful work that cannot be accurately described as a "brief" discussion.

This paragraph states that: "Acceptance of the final TWP does not imply endorsement of the consultant's technical recommendations by the CAC of EQB." What is the "final TWP" being referred to here? This sentence indicates it is a document written by one consultant ("the consultant's" technical recommendations). Due to the way this paragraph is constructed, readers may confuse the "final TWP" --about which a disclaimer is being presented here-- with the TWP by Marlene Halverson. If a disclaimer about Halverson's TWP is in fact intended here, then a disclaimer about all other submissions should also be included.

Finally, we wish to express our appreciation to the CAC for the four recommendations the CAC adopted in June, and which we urge you to retain in the final GEIS, and to strengthen:

Establish humane codes of practice for Minnesota animal agriculture that reflect scientific knowledge and public concerns regarding the health and well-being of agricultural animals;

Research animal production methods that foster animal welfare. It should be the goal to promote systems that are both supportive of animal welfare and are economically feasible. The basic animal welfare practices should be disseminated widely among educational institutions in the State;

Develop voluntary certification programs that include basic animal welfare standards. Encourage and facilitate marketing of the products of such programs;

The state should consider farmer and farm-worker certification programs to ensure that people responsible for animal care understand the basic principles of animal biology and behavior.

The above 4 conclusions provide a sound basis for directing Minnesota agriculture. We urge that the following principle be incorporated into #2, after the second sentence of paragraph #2: To this end, the State should help to revitalize a culture of independent family farm husbandry in which the humane treatment of animals is a reflection of deeply held values and in which good stockmanship skills can be passed on from generation to generation

We also urge animal welfare scientists and advocates be involved in drafting the humane codes of practice.

We wish to comment on two other parts of the draft GEIS:

In respect to the Human Health section, the State's summary of CAC themes says that human health should be protected first, that human health must come before animal welfare. However, the Technical Working Paper describes very clearly the ways in which human health is dependent on the health of the animals we use for food. Animal welfare, that is to say, animal health and well-being, is the foundation of a healthy food system. It is rational to accept that to be healthy, people must live in healthy environments and eat food from healthy animals, that is, from animals who do not need to be medicated to grow or reproduce. The relationship between human and animal health or disease and the way it is jeopardized in many to today's system for raising farm animals and the way it can be protected through use of biologically sound animal husbandry should be laid out in the GEIS.

In the Economic section we urge you to also address animal welfare. In our experience, independent family farmers can make incredible strides to improve the welfare of animals if they are given the opportunities -particularly markets and a fair price in the market place- for doing so. We can't simply rely on consumers to pay more for the products of such farms. We also need institutional incentives directed to the independent family farmers who have suffered economically due to the expansion of large-scale and/or vertically integrated livestock operations. There are enough connections between animal welfare and sustainability to make institutional incentives for humane husbandry viable for improving both sustainability and animal welfare.

January 2, 2002

Minnesota Planning
Animal Agriculture GEIS
658 Cedar St., Room 300
St. Paul, MN 55155

Re: Comments on Proposed Final GEIS on Animal Agriculture

I would like to reiterate the appreciation of the Board of Water and Soil Resources for all the work that has gone into this study and report to date. These efforts will help

Minnesota continue to be a leader at facilitating definition of the best courses of action to address issues and opportunities related to animal agriculture.

Following is a list of the BWSR's top priorities for action, and associated explanations, related to this GEIS on animal agriculture. This is in response to the request of George Johnson, project manager, via an e-mail message dated 12-18-01. This list is based on the recommendations of the Citizen's Advisory Committee (CAC), our review to date of the Technical Working Papers and the key role of the BWSR to help local government units assist conservation of water and soil resources on private lands. We understand that the 77 CAC recommendations were based on a consensus process and agree that the GEIS should include further refinement and prioritization of recommendations.

The extensive information produced by this GEIS should be made widely available via user-friendly electronic methods.

Explanation: This GEIS consolidated and developed substantial information that enables a more common understanding of critical issues related to animal agriculture in MN and helps define the best courses of action. The extensive written and GIS products of the GEIS need electronic tools to help search and best utilize those documents, maps and data layers.

Develop a strategy to continue to advance the understanding and use of the information assembled by the GEIS.

Explanation: The extensive information assembled by the GEIS will take quite some time to fully understand and use. The Feedlot and Manure Management Advisory Committee (FMMAC), with its broad membership, should be an important forum for ongoing education, coordination and advice to best utilize the GEIS. This includes advice from many perspectives regarding research needs and policy refinement.

The state and federal governments should remain committed to the feedlot strategies put forth in recent years via rule and other documentation, by strongly supporting targeted technical and financial assistance for feedlot pollution abatement and improved nutrient management.

Explanation: The 1999 USDA/EPA Unified National Strategy for Animal Feeding Operations and current MN Feedlot Rules define timelines for meeting water quality standards and improving manure nutrient management. The federal Environmental Quality Incentive Program (EQIP) and the state Feedlot Water Quality Management Cost-Share, Nonpoint Engineering Assistance and Ag Best Management Practices Loan Programs are key to helping solve existing manure storage, feedlot runoff and land application problems. These programs give priority to feedlots with less than 500 animal units and the greatest environmental benefit potential, and consider local water plan priorities. Many small to mid-size feedlots have been identified as having substantial pollution potential. Federal and state funding for these programs in MN should reflect a commitment to current feedlot pollution abatement strategies and water quality requirements, including the important engineering assistance role of Soil and Water Conservation Districts for feedlot fix-up investigation, design and construction inspection.

Feedlot inventory guidance should be updated to promote high quality Level 3 inventories, using current database technology, to better enable local and statewide definition of environmental conditions and needs related to feedlots.

Explanation: The GEIS has identified the need for compatible, high quality feedlot inventories to better define needs and target resources for protection and improvement of water, soil and air quality associated with feedlots. Existing feedlot inventory guidance is outdated in regard to use of current technology. Level 3 inventories, which include definition of feedlot pollution potential using the Feedlot Evaluation Model, are used for targeting of technical and financial assistance programs. Current web-based technology might offer good value to local and state government units for feedlot inventories. A web-based feedlot registration and permitting system being developed through Nicollet County should be investigated as a possible model.

Continue the development and maintenance of GIS data layers, and other monitoring and decision tools, which are critical for good siting, expansion and operation of feedlots, including sustainable land application of manure.

Explanation: The objectives of this GEIS include enabling improved feedlot project reviews and land use decisions, and improved evaluation of cumulative impacts of feedlots. Reliable information, good planning and evaluation tools and early coordination are keys to timely and effective land use and manure management decisions. The GEIS advanced the use of GIS tools for effective feedlot decision-making. It also identified the need to further develop and utilize the MN Phosphorus Index, MN Nutrient Management Planning software, Feedlot Evaluation Model, air quality decision tools, and the definition of sensitive groundwater and surface water areas. Digital soil survey data, and digital sinkhole probability maps for the karst region of MN, are examples of other data sets that can substantially assist feedlot and manure management planning. A web-based version of the Feedlot Evaluation Model would help address compatibility with different user operating systems. The federal, state, local and private partnerships that have evolved in MN for improved nutrient management (e.g. refined U of M manure application recommendations, improved nutrient management planning tools, and education for livestock producers, public and private technical assistance providers and manure applicators) should continue to be supported by federal and state programs, producer groups and others. These efforts should include application of current technology to monitoring and reporting of environmental outcomes.

Coordination and clarification of the top priorities of the involved agencies, organizations and interest groups should be a topic of further discussion via the FMMAC and other venues. These discussions should include definition of who can do what to advance these priorities for action, and what additional resources and policy changes are needed.

Thanks for the opportunity to further contribute to refining the products and use of this GEIS.

If you have questions about these comments, please contact Al Kean at 651-297-2907 or al.kean@bwsr.state.mn.us.

Sincerely,

Ronald D. Harnack
Executive Director

April 2, 2002

George Johnson, Project Manager
Animal Agriculture GEIS
Minnesota Planning
658 Cedar St., Room 300
St. Paul, MN 55155

RE Comments on the November 26, 2001 Proposed Final Generic Environmental Impact Statement on Animal Agriculture

Dear Mr. Johnson:

I believe that the Generic Environmental Impact Statement on Animal Agriculture, when viewed as a whole, fulfills the charge of the legislature and does the best job possible, within the limitations of time and budget, to fulfill the goals and objectives outlined in the scope. The GEIS is a major step forward in bringing together credible information from a wide variety of sources to "develop a basic understanding of animal agriculture in Minnesota." It also goes a long way to "identify and assess the environmental, economic, and social effects…with particular emphasis given to any cumulative effects." As addressed in the History section of the proposed Final GEIS summary, the GEIS was unable to identify alternative paths for animal agriculture, or to provide consensus on choices among the alternative paths. In retrospect, this is understandable, given the huge variation and complexity of the livestock sector and the environments in which it operates.

One of the major concerns of this agency, and the MPCA as well (letter from Commissioner Studders dated January 30, 2002), is how the GEIS is used in project-specific environmental review. While it is clear from the GEIS and the environmental review rules that a GEIS cannot substitute for project-specific environmental review, it is also true that one of the major reasons for undertaking a GEIS is to generate information that is difficult to address on a case-by-case basis. MDA's hope from the outset has been that the GEIS will lessen the burden of environmental review on individual project proposers, allowing the livestock industry as a whole to thrive, while protecting Minnesota's environment.

Social and economic impacts are an area where the GEIS provides information that may be useful for project-specific environmental review. We hope that much of this information can be incorporated by reference into project-specific environmental review documents with little need for additional information-gathering or analysis by project proposers. However, as we discussed in our comments on the Draft GEIS, more work needs to be done in assessing the economic impact of livestock production in the state.

It is hoped that information on environmental impacts, particularly cumulative air and water impacts, will also lessen the burden on individual proposers of livestock projects. While it is now clear that this broad statewide effort will be unable to answer all of the cumulative impact questions surrounding individual projects, MDA still believes that it should mainly be the responsibility of the public sector, rather than individual project proposers, to provide an assessment of cumulative impacts to the environment. The next policy steps resulting from the GEIS, therefore, should be focused on more specific work in the area of cumulative impact analysis, particularly of air and water impacts.

To this end, the GEIS recommendations that speak to an agenda for better addressing cumulative impacts should be the top priorities. In the area of air quality and odor, the EQB should develop a research agenda to build on the work of the University of Minnesota and the MPCA to develop predictive models. The objective should be for the state to develop or acquire sound, proven, and well-accepted methods for assessing individual and cumulative air quality and odor impacts of feedlot proposals. These methods should be able to be disseminated to feedlot officers and other local and regional staff involved with feedlot review, along with any necessary training, so that air and odor modeling can be conducted at nominal cost to the project proposer. Consensus recommendations 12, 13, 16, and 20 speak to this objective, but should be combined and reworked into a comprehensive agenda that can be advanced by the EQB.

The EQB should also outline a comprehensive agenda for addressing cumulative water impacts. Again, we believe the burden of addressing cumulative impacts should be on the public sector. This probably needs to be accomplished by study of smaller, relatively homogeneous geographic units, such as watersheds or agroecoregions. Such study should build upon work currently in progress, such as the development of the Phosphorous Index by the University of Minnesota (an outgrowth of the Animal Agriculture GEIS), and the paired watershed studies for nutrient reduction in the Minnesota River Basin, a farmer-led and initiated effort in cooperation with the University of Minnesota and state and local agencies.

Aside from these two major priorities addressing air and water impacts, we would also consider the following recommendations as high priority:

> *Encourage the formation of a program similar to the Michigan Agriculture Environmental Assurance Program (MAEAP). This would be a comprehensive proactive, and voluntary agricultural pollution prevention program, which ensures that participating producers use effective land stewardship practices that comply with local, state and federal regulations. Certification of feedlots would be included. (23)*
>
> *Make the cost incurred to comply with the Phosphorus index and improved Nitrogen management for land application eligible for cost share funding under programs administered by BWSR, MDA, USDA and MPCA. (24)*
>
> *Develop a strategy and prioritize mitigation activities to move towards compliance with TMDL's (total maximum daily loads) in impaired watersheds (41)*
>
> *Create an emerging issues research agenda. The results of relevant research would be reported as annual updates to the animal agriculture GEIS. (53)*
>
> *Develop an efficient, environmental -sound, community and producer-friendly, permitting process which supports, enhances, and attracts processing facilities. (75)*
>
> *The CAC recommends a continued moratorium on the construction of new open-air swine basins, except existing facilities may use basins of less than 1 million gallons capacity as part of a permitted waste treatment program for resolving a pollution problem or to allow conversion to a different animal type, provided all standards are met. (77)*

Thank you for all your excellent work on this important document.

Sincerely,

Gene Hugoson
Commissioner

GH:AgD:bp

Mr. Gene Hugoson, Commissioner
Minnesota Department of Agriculture
90 West Plato Boulevard
Saint Paul, MN 55107

RE: Summary of the Minnesota Pollution Control Agency Policies and Priorities for the Animal Agriculture Generic Environmental Impact Statement Policies and Priorities Document.

Dear Commissioner Hugoson:

The enclosed memorandum summarizes the policies and priorities of the Minnesota Pollution Control Agency (MPCA) as they pertain to the Generic Environmental Impact Statement (GEIS) on Animal Agriculture. The MPCA understands that this summary will be included in the Policies and Priorities section of the GEIS. The GEIS policies and priorities are addressed along three main areas: Direct, Indirect and Cumulative Environmental Impacts; Administrative Issues; and Education and Outreach Activities.

The MPCA recognizes that the environmental effects related to agricultural production are highly complex and require significant resources and expertise to adequately characterize both impacts and solutions. As required pursuant to Laws of Minnesota 1998, Chapter 366, Sec. 86, the GEIS was intended as a means to develop a body of knowledge that would provide "…a basic understanding of animal agriculture…" as well as "…identify and assess the environmental, economic and social effects…" that livestock production has on the environment. While the MPCA does not agree with all the issues presented in both the Technical Work Papers (TWPs) and the draft Final GEIS document, the MPCA does agree that the body of work provides a basic understanding of the environmental impacts posed by livestock production. More importantly, the GEIS process identified the areas of uncertainty currently present in our understanding of the various technical, social and economic issues related to animal agriculture.

A need exists to determine how the GEIS is kept current, how to manage future information, and how to ensure that future efforts to engage a broad discussion are managed. The MPCA desires to participate in such a dialogue to ensure joint efforts by members of the EQB are productive and efficient.

On behalf of the MPCA, I want to thank you, your staff, and the Citizens Advisory Committee for your hard work and effort. If you have any questions or comments related to this correspondence, please feel free to contact Myrna Halbach, Feedlot Program Manager, at (320) 214-3794.

Sincerely,

Karen A. Studders
Commissioner

KAS:REM:kr

Enclosure

cc: The Honorable Charles Berg, Minnesota State Senator
The Honorable Steve Dille, Minnesota State Senator
The Honorable Jane Krenz, Minnesota State Senator
The Honorable Leonard Price, Minnesota State Senator
The Honorable Dallas Sams, Minnesota State Senator
The Honorable Kenric Scheeval, Minnesota State Senator
The Honorable Tim Finseth, Minnesota State Representative
The Honorable Mark Holsten, Minnesota State Representative
The Honorable Dennis Ozment, Minnesota State Representative
Environmental Quality Board Members
MPCA Citizens' Board Members
Steve Bosacker, Chief of Staff

DATE : May 6, 2002

TO : Karen A. Studders
Commissioner

FROM : Rodney E. Massey
Director
Regional Environmental Management Division

PHONE : (651) 296-7202

SUBJECT :
Summary of the Minnesota Pollution Control Agency Policies and Priorities for the Animal Agriculture Generic Environmental Impact Statement Policies and Priorities Document.

The MPCA provides the following policy and priority comments to the Environmental Quality Board (EQB) in order of importance.

Direct, Indirect and Cumulative Environmental Impacts

The MPCA is often confronted with issues related to the direct, indirect and cumulative environmental impacts of animal agriculture during the environmental review and permitting of feedlots. Typically, these issues relate to potential direct impacts a project may have on the environment (e.g. impaired surface waters, contaminated drinking water supplies, odor). The public has also expressed concern regarding the indirect long-term impacts a project may present and the cumulative impact that a number of livestock production operations present to the environment in a given region. Recent investigations have also demonstrated that our local and regional environmental issues can impact the global environment as observed with the hypoxic condition in the Gulf of Mexico. The MPCA believes that future research and data collection efforts are needed to assess the various environmental impacts of agricultural production. This effort should be an active partnership between private and public interests. The GEIS process identified a number of areas where the science of an issue is incomplete or unavailable. It is understood that much of this information is emerging and it is important to use this information to fill some of the technical gaps of the GEIS. However, the MPCA maintains that the burden of assessing the various environmental impacts for a specific project should be placed on the project proposer as required under environmental review statutes and rules.

Research and assessment are critical factors in the characterization and understanding of environmental impacts. However, it is important that the various regulatory agencies accommodate this effort by aligning to new information as it is presented. The MPCA feels that an effective way to address the environmental issues posed by agricultural production is through a basin and watershed management structure. The MPCA believes that the GEIS Policy Recommendations (PR) that most closely addresses this concept are found in PR# 33, 41, 42, 52 and 58. The transition to a watershed management system is a high priority for the MPCA. A comprehensive statewide watershed management strategy would provide comprehensive data collection and management as well as assist decision-makers and policy experts with a better understanding of agriculture and the environmental condition of a specific area. Additionally, the watershed management structure lends a better research framework to address the issues described in PR# 32, 37, and 43.

The environmental impacts and air quality control technology related to air pollutants generated from livestock production is an emerging science. The MPCA believes that the existing science and predictive tools are adequate to address potential environmental impacts, however, further information is needed to refine this process. The MPCA believes that PR# 12, 17 and 20 should be a high priority as they are important research and data management directions that will further the understanding of the environmental impacts of air pollutants from livestock operations.

MPCA GEIS Policy Recommendation Priorities

Priority #1

Air Quality – PR# 20 – Support increased federal funding for air quality and odor research and incentives for improvement related to feedlots [AFO, CAFO].

The MPCA believes that the direct, indirect and cumulative impacts of air emissions from livestock production facility requires further research to better characterize the nature and composition of the various emissions sources. This information is a critical component to assess potential environmental impacts on human health and the environment as well as to address cumulative impacts of multiple emission sources.

Priority #2

Role of Government – PR# 52 – Compile existing validated data and conduct research that provides for more consistent environmental baseline and outcome data to assess progress against identified priorities. Information that is available should be integrated with the new feedlot registration program and made accessible to the public, state and local officials.

The compilation and development of baseline environmental data is important to assess the various direct, indirect and cumulative impacts of livestock agriculture. Additionally, a comprehensive environmental baseline dataset will greatly assist future research activities and livestock project proposals as they navigate the environmental review and permitting process.

Priority #3

Water Quality – PR# 43 – Support paired watershed studies that evaluate the impact of existing management practices and Best Management Practices (BMP's) on water quality. Review results to make recommendations for nutrient handling including adjusting rules and accelerate adoption of

BMP's using results from the paired watershed studies. Range of scales studied could be from 20 acres to 10,000 acres that would allow analysis on different levels.

The MPCA believes that the most effective method available to address cumulative impacts of livestock agriculture on surface and ground-water resources is through a paired watershed approach whereby land use and agricultural management practices are assessed in context to their impact on water quality within a watershed.

Priority #4

Human Health – PR# 4 – We support research to characterize health effects, quantify source strength, and determine environmental fate of outputs of animal agriculture that have the highest potential for human health impacts. Publicly funded research and public-private partnerships are recommended to spread out the costs of basic and applied research.

The MPCA believes that it is important to fund research that will address the cumulative air and water quality impacts agricultural chemicals, bacteria, pathogens and antibiotics have on human health and the environment.

Administrative Issues

The GEIS conducted a review of the administrative functions of the MPCA and provided a number of recommendations designed to improve the efficiency and effectiveness of the organization related to feedlot permitting, complaint response and enforcement activities. However, the GEIS did not address the role that citizen/producer conflict plays in the environmental review and permitting process.

As a general policy, the MPCA will continue to improve the feedlot odor complaint process (PR# 14) and enforce the state ambient hydrogen sulfide air quality standard (PR# 21). The MPCA is also committed to improving its working relationship with delegated county partners to inspect and enforce Minnesota feedlot regulations (PR# 57 and PR# 29). The GEIS indicates that the MPCA feedlot permitting process should be more efficient and predictable (PR# 69). The MPCA believes that this is an achievable goal once the following tasks are complete: the role and relationship of the various levels of government are better defined and understood by the public; and conflicts regarding land use and social issues are addressed in the appropriate forum rather than directed to the environmental review and permitting process. The MPCA intends to work with stakeholders to identify areas where efficiencies can be gained while preserving environmental protection and public discourse.

The GEIS has identified the need to coordinate the efforts between various federal, state and county governmental entities with respect to overall environmental protection (PR# 33 discusses this process with respect to water quality data). The MPCA agrees that some form of centralized coordination is needed to address the various environmental media and regulatory issues. While the GEIS does not directly address this approach, the MPCA asserts that the best direction is the development of an integrated data management system that will provide easy access to environmental baseline data and regulatory information for a given area.

The information provided in the GEIS is a clear indication that new issues are commonplace in agricultural production. The GEIS addressed this issue by recommending the creation of an emerging issue agenda (PR# 53). The MPCA believes that an emerging issue agenda with full participation by public and private interests is an effective means to address these concerns and is a high priority for the agency.

MPCA GEIS Policy Recommendation Priorities

Priority #5

Land Use Policy – PR# 47 – Explore and evaluate conflict management tools to address conflict situations. Make these tools available for use by and at the direction of local units of government.

The MPCA often encounters conflicts between citizens and livestock project proposers during the environmental review and permitting phase. Often times, these conflicts are not related to environmental issues, however, they erupt in the environmental review and permitting forum. It is important that the state recognize the nature of the conflict and identify appropriate alternatives to address these issues outside of the environmental regulatory process.

Education and Outreach

The MPCA believes that PR# 46 and PR# 56 are high priorities with respect to education and outreach as they address fundamental governmental unit training needs (i.e. County Feedlot Officers and Local Officials) and public information on the various roles of government related to livestock permitting and regulation.

MPCA GEIS Policy Recommendation Priorities

Priority #6

Land Use Policy – PR# 46 – Promote public education on the responsibilities and limitations of each level of government (local, state and federal) in regulating feedlots and handling complaints. Inform citizens of lawful methods of redress available in dealing with conflict over feedlot operations and management.

Citizens are often confused on the appropriate role each level of government has with respect to the permitting and regulation of livestock operations. Additionally, citizens are often unaware of their various administrative equitable and judicial rights available to them at each level of government. The State of Minnesota would benefit from an education campaign that illustrates the roles and responsibilities of each level of government with respect to the livestock regulation issues. The major benefit of this activity is that it promotes a predictable livestock permitting process that provides for public discourse at the appropriate level of government.

REM:kr

Appendix F1

Primary References for GEIS

Generic environmental impact statement on animal agriculture:
Scoping Document / Minnesota Environmental Quality Board.
1998 **English** Book 14 p. : graphs ; 28 cm.
http://www.mnplan.state.mn.us/press/1999/eqb/geis/

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1999 **English** Book 2 v. ; 30 cm.

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prepared for the generic environmental impact statement on animal agriculture /
Minnesota Planning (Agency); Environmental Quality Board (Minn.)
2001 **English** Book, [96] p. ; 30 cm.
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prepared for the generic environmental impact statement on animal agriculture /
Minnesota Planning (Agency); Environmental Quality Board (Minn.)
2001 **English** Book, [155] p. : maps (some col., some folded), charts ; 30 cm.
Coleman, Jean, et. Al. Biko Associates, Inc. Minneapolis, Minnesota

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for the generic environmental impact statement on animal agriculture in Minnesota /
Minnesota Planning (Agency); Environmental Quality Board (Minn.)
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Final technical working paper - Economic structures, profitability & external costs.
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Lazarus, William F., **Corp Author(s):** University of Minnesota.; Dept. of Agricultural Economics. ;

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Minnesota Planning (Agency); Environmental Quality Board (Minn.)
2001 **English** Book, 128 p. : maps, charts ; 30 cm.
Mulla, D. J. **Corp Author(s):** University of Minnesota.; Dept. of Soil, Water, and Climate. ;

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prepared for the generic environmental impact statement on animal agriculture /
Minnesota Planning (Agency); Environmental Quality Board (Minn.)
2001 **English** Book iv, 94, [46] p. : ill., charts ; 30 cm.
Valentine, Michael, et. Al. EarthTech Environmental Remediation and Waste services, Minneapolis, Minnesota

Final Technical work paper - Soils, Manure and Crop Nutrients :
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Minnesota Planning (Agency); Environmental Quality Board (Minn.)
2001 **English** Book, 109 p. : maps, charts ; 30 cm.
Moncreif, John and Bloom, Paul, et al. **Corp Author(s):** University of Minnesota.; Dept. of Soil, Water, and Climate.

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2001 **English** Book iv, 94, [46] p. : ill., charts ; 30 cm.
Valentine, Michael, et. al. EarthTech Environmental Remediation and Waste services, Minneapolis, Minnesota

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2001 **English** Book, [314] p. : ill., charts ; 30 cm.
Halverson, Marlene, et. al. Northfield, Minnesota

Feedlot Financial Needs Assessment Report, Minnesota.
2001 **English** Book : 38 p. ; 28 cm.
St. Paul, MN : Minnesota Dept. of Agriculture, Agricultural Development Section,

Feedlot Air Quality Stakeholders Report : 1999 field season.
Minnesota Pollution Control Agency.
1999 **English** Book 1 v. (various foliations) : ill. ; 28 cm.
[St. Paul, MN] : Minnesota Pollution Control Agency,

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University of Minnesota.; Minnesota.
1999 **English** Book 9 leaves ; 28 cm. + attachments.
Jacobsen, Larry, et al: University of Minnesota, Biosystems and Agricultural Engineering Dept.

APPENDIX F2

GEIS Complete Bibliography by Topic

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APPENDIX G

University of Minnesota
Feedlot Air Quality Research

Emissions of Ammonia, Hydrogen Sulfide, Odor, Particulate Matter
And
Correlation of Odor with Air and Manure Chemistry

Two Final Reports
Submitted to the Environmental Quality Board (GEIS) and the
Minnesota Department of Agriculture
January 15, 2001

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Introduction

Information regarding the concentration and emissions of gases and dust from livestock facilities is greatly needed. Concentrations of dust and various gases in livestock facilities can affect both human and animal health. These indoor air concentrations of dust, hydrogen sulfide and ammonia are regulated through the Occupational Health and Safety Administration (www.OSHA.gov). Recent attention however has been placed on the ambient air quality surrounding livestock facilities. This ambient air quality is a function of the amount of dust and gases emitted from the facilities and the downwind transport and transformation of these constituents. Environmental regulatory agencies at both the state and local level are currently reviewing emissions of gases and dust from livestock facilities in an attempt to determine if these facilities 1) violate current air emission standards, or 2) have a significant impact on ambient air quality. This study was designed to help answer these questions through the continuous measurement of emissions of ammonia, hydrogen sulfide, and particulate matter in three representative livestock facilities. A second related project is reviewing the downwind transport and air dispersion modeling from these facilities, while a third related project attempts to correlate odor emissions to specific gas emissions or manure chemistry. Results from these other projects are reported separately.

A recent European study documented ammonia and dust emissions from several livestock and poultry facilities in four countries in Europe (Takai et al., 1998; Groot Koerkamp et al., 1998). Results from these studies are summarized in Table 1 and Table 2. Both gas and dust emissions rates were a function of the ventilation rate of the building and the concentration of the constituents in the exhaust air. These concentrations and ventilation rates are affected by a variety of factors including indoor and outdoor temperatures, building design, manure handling system, animal diet, animal numbers and sizes, etc. As such, and as can be seen in Table 1, there is a large variation in emission values reported. Dust emission variations were attributed to differences in housing design and management, and climatic differences between countries. It is likely that similar variations in emissions would be found in similar buildings throughout the United States and possibly between similar sites in Minnesota. As such, it is important to review the data in this study as a first step in quantifying emissions from these types of buildings.

Table 1. Ammonia emissions from European study (Groot Koerkamp et al., 1998)

	mg/h/500 kg live weight			
Housing	England	The Netherlands	Denmark	Germany
Broilers, litter	8294	4179	2208	7499
Swine finish, slats	2592	2076	2568	2398
Dairy, freestall	1048	1769	843	1168

Table 2. Dust emissions from European Study (Takai et al., 1998)

	Inhalable emissions / respirable emissions mg/h/500 kg live weight			
Housing	England	The Netherlands	Denmark	Germany
Broilers, litter	6218/706	4984/725	1856/245	2805/394
Swine finish, slats	895/133	418/40	604/57	532/34
Dairy, freestall	21/18	216/54	115/13	338/29

Limited data exists on the emissions of hydrogen sulfide and odor from livestock and poultry facilities. Most of the recent studies documenting these emissions have been conducted at the University of Minnesota or Purdue University. Emission values reported in literature are given in Tables 3 and 4. Note that these values were converted to common units as indicated in Wood et al. (2001).

Table 3. Hydrogen sulfide emissions found in literature.

Housing	Hydrogen sulfide	Units	Source
Broilers, litter	1	mg/hr/m^2	Wood et al., 2001
Swine finish, slats	50	mg/hr/m^2	Wood et al., 2001
	7-97	mg/hr/m^2	Ni et al., 1998
	1-30	mg/hr/m^2	Heber et al., 1997
Dairy, freestall	3.6	mg/hr/m^2	Wood et al., 2001

Table 4. Odor emissions found in literature.

Housing	Odor	Units	Source
Broilers, litter	0.5	$OU/s/m^2$	Wood et al., 2001
	3-10	$OU/s/m^2$	Jiang et al., 1998
Swine finish, slats	6.8	$OU/s/m^2$	Wood et al., 2001
	13.7-19.2	$OU/s/m^2$	Verdoes et al., 1997
	1.4-15.1	$OU/s/m^2$	Klarenbeek et al., 1985
Dairy, freestall	1.3	$OU/s/m^2$	Wood et al., 2001

Methodology

Air emissions monitoring was conducted at one turkey, one swine and one dairy farm in Minnesota. Continuous monitoring of ammonia and hydrogen sulfide emissions was done at each site for approximately ten days of cold weather and ten days of warm weather (Table 5). Grab dust samples of dust were taken twice during each monitoring period while odor samples were taken once during the summer monitoring period. Sites were chosen based on the lack of other livestock or poultry farms nearby, the cooperators willingness to participate in the project, and the timing of the animal production cycles. The goal was to monitor barns that were at or near capacity of near market weight or mature animals, assuming that this would provide the worst case scenario for gas and dust emissions.

Table 5. Sampling schedule in 2001.

	Winter Sampling		Summer Sampling	
Farm	Dates (Average ambient T, ºC)	# animals (lbs/ animal)	Dates (Average ambient T, ºC)	# animals (lbs/ animal)
Turkey	01/26-02/09 (-6.9º)	11,200 (40)	06/04-06/15 (20.7º)	12,391 (5)
Swine	02/19-03/05 (-8.4º)	1000 (225)	06/26-07/18 (23.8º)	1033 (155)
Dairy	03/04-03/19 (-1.8º)	500 (1400)	5/23/01-6/03/01 (14º)	500 (1400)

Turkey site

The turkey barn monitored consisted of a single grow-out barn. The barn was a conventional 60 feet x 560 feet curtain sided barn oriented north-south. Eight week old birds enter the barn at approximately eight pounds. Birds leave the building after sixteen weeks and weigh approximately 40 lbs. The building has a capacity of 12,000 birds.

Swine Site:

The swine site consisted of two 2000 head finishing barns oriented east-west. Each of the 2000 head barns divided into two 1000 head rooms. The barns were all curtain sided, deep pitted barns with dimensions of 41 ft x 400 ft. The barns were mechanically ventilated in cold weather (pit fans) and naturally ventilated in warm weather. Only one of the four barns was monitored for air emissions.

Dairy Site:

The dairy barn monitored was a 550 cow freestall barn, 110 feet x 340 feet oriented east-west. It was a naturally ventilated skid loader scrape barn with mattresses and sawdust bedding in the freestalls. Several other odor sources were present on the farm but did not interfere with the emissions monitoring.

Sampling setup for gas measurements

Three, 75 foot Teflon air sampling lines were installed in each of the barns evaluated. Multiple sampling lines were used in order to obtain representative sample concentrations in the barn or in some cases, to get ambient conditions or evaluate different exhaust streams. The three sample locations are shown in Table 6. Sampling lines were heated using heat tape and insulated between the barn and the equipment trailer to avoid condensation in the lines. The equipment trailer was environmentally controlled to provide conditions necessary for the measurement equipment.

A vacuum pump and solenoid valves in the trailer were used sequentially to draw air from each of the sampling lines into a manifold (ten minutes for each sampling line). Air from the manifold was sampled for carbon dioxide using an infrared gas monitor (Model 3600 Mine Safety Appliance, Pittsburg, PA), hydrogen sulfide using a chemcassette recorder (Single Point Monitor, Zellwiger Analyitical, Lincolnshire, IL) and ammonia using a chemiluminescence nitric oxide (NO) analyzer and a thermal ammonia (NH3) converter (model # 17C Thermal Environment Instrument, Franklin, MA). Data was recorded using a CR 21X data logger (Campbell Scientific, Logan, Utah).

Table 6. Location of sampling lines in barns (all measurements from SW corner of barn).

	x,y,z coordinates in barn (ft) x=east distance from SW corner of barn y=north distance from SW corner of barn z=height of sampling line above floor		
Barn and season	Line 1	Line 2	Line 3
Turkey winter	15, 80, 6	30, 80, 6	45, 80, 6
Turkey summer	15, 80, 6	ambient	15, 80, 6
Swine winter	100, 15, 6	100, 30, 6	100, 45, 6
Swine summer	100, 15, 6	ambient	100, 45, 6
Dairy winter	100, 25, 10	100, 50, 17	100, 80, 10
Dairy summer	100, 25, 10	ambient	100, 80, 10

Dust Measurements

Two, 24-hour dust measurements were made each sampling period. Dust sampling equipment was located near the center of each of the barns at heights of 7 ft, 5 ft and 10 ft above the floor for the turkey, swine, and dairy sites, respectively. Four different dust samplers were used to determine concentrations of the different particle sizes in the barns. Current standards for indoor air quality in livestock and poultry facilities typically use measurements of "inhalable" and "respirable" dust (particles less than 20 micron* and 5 micron*) while ambient air quality standards commonly refer to "PM_{10}" (particles less than 10 microns). Note that 1 micron = 1 x 10^{-6} meters. Total dust is also a measure commonly used but due to the different measurement methods used, "total dust" concentrations are slightly misleading and often can be less than the "inhalable" concentrations. "Total," "inhalable," and "respirable" dust, were measured using a standard filter cassette system (SKC Model 225-70A and 225-01-10, SKC, Eighty Four, PA). PM_{10} (particles less than 10 microns) were measured using a MiniVol Portable Air Sampler (Airmetrics, Eugene OR). "Total," "inhalable," and "respirable" dust measurements were sampled in duplicate each sampling time for four data sets per sampling period. Duplicate PM_{10} measurements were not conducted because of limited equipment so there are only two measurements for each sampling period.

Ventilation measurements

Ventilation rates are one of the most important yet difficult measurements to make when evaluating emissions from naturally ventilated buildings. For this study, a method commonly referred to as the "carbon dioxide balance method" was used to determine the ventilation rates. This method compares the ambient carbon dioxide to the carbon dioxide concentrations in the exhaust. This difference is related to the amount of carbon dioxide given off by the animals, which is estimated using the number and weight of the animals, and the airflow through the barn. Unfortunately, large variations in carbon dioxide can exist in buildings because of incomplete mixing in the barn and other sources of CO2 generation (e.g., manure decomposition). A standard ambient air concentration of carbon dioxide of 345 ppm was used in this study due to the difficulty in accurately measuring the ambient CO2 concentration on site.

Results

Ammonia, Hydrogen Sulfide, and Odor Concentrations

Average, median, minimum, and maximum ammonia, hydrogen sulfide, and odor concentrations for each sampling period are given in Tables 7 through 9. Unfortunately, equipment used for measuring hydrogen sulfide had restricted ranges of 1-90 ppb or 50–1500 ppb. Often measurements in the barn varied considerably resulting in concentrations either above 90 ppb or below 50 ppb. This equipment limitation primarily affected the measurements made in the summer on the swine facility. During this sampling period the 50-1500 ppb range was selected. Often the concentration in the barn was less than the 50 ppb so no average, median, or minimum concentration could be reported. In some cases, ammonia concentrations in the swine and turkey barns exceeded the 20 ppm equipment limits. Fortunately, these exceedances were rare (once or twice in the sampling period). As such, emission values were calculated using the maximum concentrations (20 ppm) for those periods.

Table 7. Ammonia concentrations.

		Ammonia concentration (ppb)			
Species	Sample period	Average	Median	Minimum	Maximum
Turkey	Winter	1700	860	10	*
Turkey	Summer	8460	8550	820	*
Swine	Winter	9120	9050	160	19090
Swine	Summer	6310	5240	565	*
Dairy	Winter	240	190	40	4380
Dairy	Summer	1140	890	310	4920

*above limit of equipment (20000 ppm)

Table 8. Hydrogen sulfide concentrations.

		Hydrogen sulfide concentration (ppb)			
Species	Sample period	Average	Median	Minimum	Maximum
Turkey	Winter	0	0	0	3
Turkey	Summer	0	0	0	40
Swine	Winter	6	4	0	71
Swine	Summer	-	-	-	301
Dairy	Winter	0	0	0	0
Dairy	Summer	2	2	0	15

Table 9. *Odor concentrations.

Species	Sample period	OU
Turkey	Summer	140
Swine	Summer	404
Dairy	Summer	280

*Only one set of measurements taken during the summer sampling period.

Ammonia and Hydrogen Sulfide Emissions

Emission measurements for hydrogen sulfide and ammonia are the product of the gas concentration (mass of gas per volume of air) and the ventilation rate (volume of air per time exhausted) for the building (µg/m3 * m^3/s). Both the ventilation rate (based on the indoor carbon dioxide concentration) and ammonia or hydrogen sulfide concentration were sampled every 30 minutes from each sampling line. These values were averaged to get one hour emission rates. Note that these emission rates assume ambient (background) concentrations of hydrogen sulfide and ammonia to be zero, therefore, these recorded values may slightly overpredict the true emission rates from the buildings. To make calculations of true emission rates, background concentrations of inlet air would need to be measured. These measurements were attempted in this study but is as often the case with naturally ventilated buildings, it was difficult to get representative samples of inlet air.

Average emission rates for ammonia and hydrogen sulfide are reported in Tables 10 through 12. These rates are the average of the hourly emission rates over the sampling period. As can be seen in Figure 1, as ventilation rate increased the concentration of ammonia decreased resulting in constant emission rates (Figure 2).

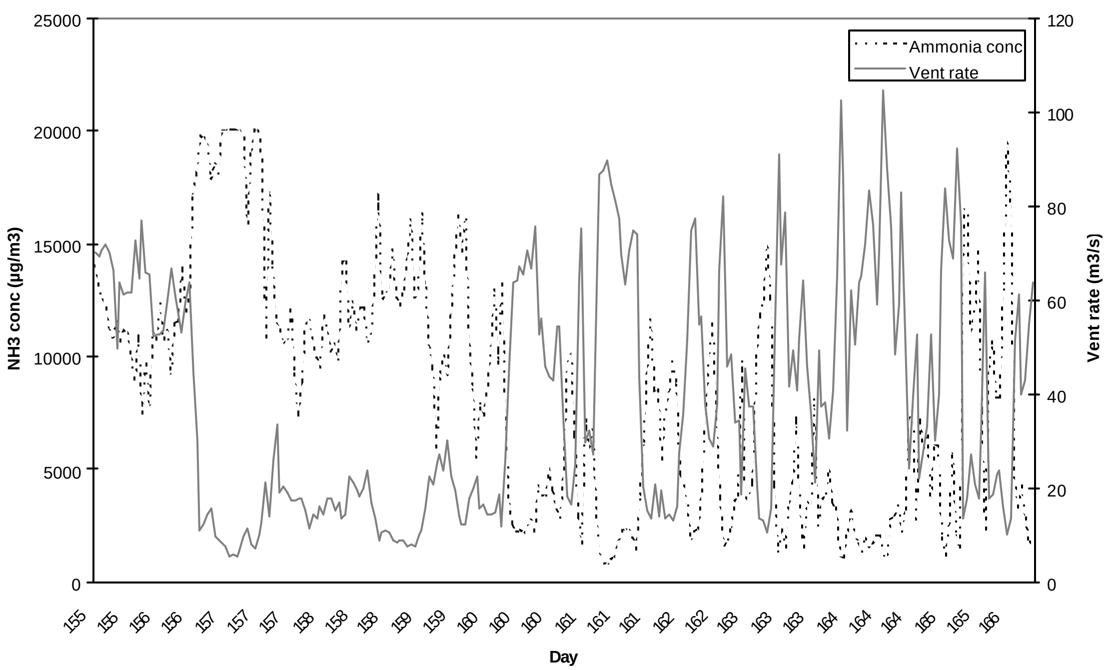

Figure 1. Ventilation rate and ammonia concentration on turkey site in summer.

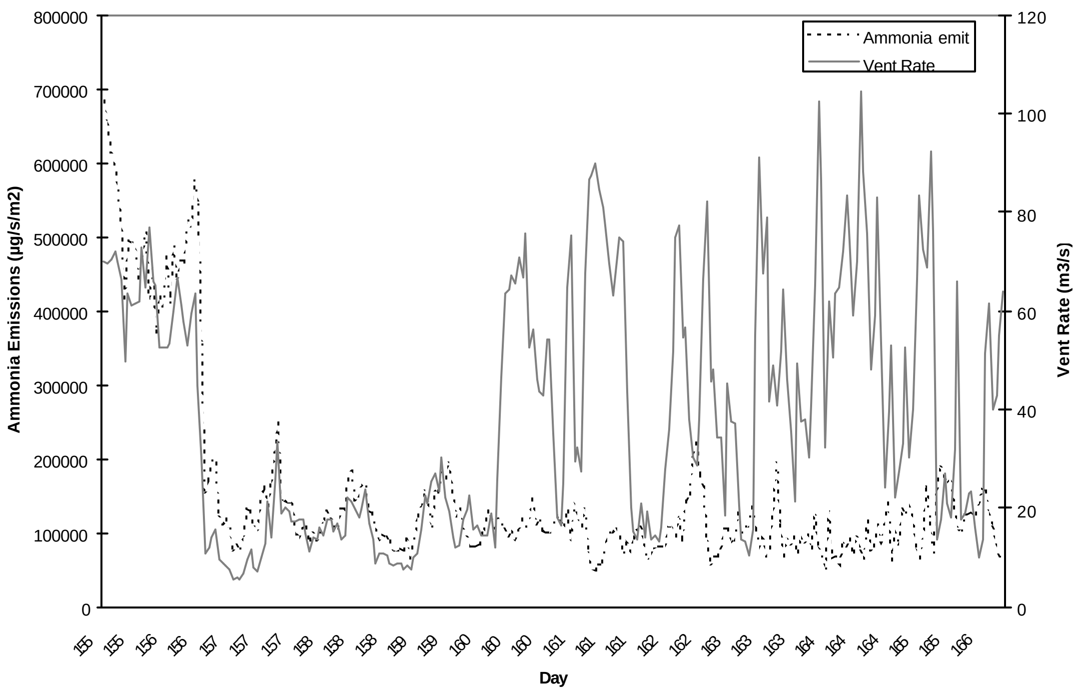

Figure 2. Ventilation rate and ammonia emissions on turkey site in summer.

Table 10. Average ammonia emission rates.

	mg/h/500 kg live weight		mg/h/square meter of building	
Species	Winter	Summer	Winter	Summer
Turkey	256	12,347	34	178
Swine	273	2751	73	526
Dairy	224	481	42	90

Table 11. Average hydrogen sulfide emission rates

	µg/h/500 kg live weight		µg/h/square meter of building	
Species	Winter	Summer	Winter	Summer
Turkey	98	1276	13	18
Swine*	290	-	78	-
Dairy	27	2919	5	548

* Summer data not available because of limits on H2S sampling equipment.

Table 12. Odor emissions*

Species	Sample period	OU/s/500 kg live weight	OU/s/square meter of building
Turkey	Summer	33	0.5
Swine	Summer	55	15
Dairy	Summer	101	19

*Only one set of measurements taken during the summer sampling period.

Dust concentrations and emissions

Dust concentrations (mean and standard deviation) for each sampling period are shown in Table 13. Current federal regulations are limited to ambient PM_{10} concentrations, however, for comparison purposes with European data inhalable and respirable emissions were also calculated. These values are based on the 24 hour concentrations in the barn and the average ventilation rate during the 24 hours when the measurements were taken. These values are found in Tables 14 through 16.

Table 13. Dust concentrations.

Species	Total (mg/m^3) Mean (sd)	Inhalable (mg/m^3) Mean (sd)	Respirable (mg/m^3) Mean (sd)	PM10 (mg/m^3) Mean (sd)
Winter				
Turkey	4.26 (3.14)	3.54 (1.76)	0.51 (0.24)	1.11 (0.34)
Swine	6.86 (1.30)	4.56 (2.74)	0.44 (0.15)	1.63 (0.16)
Dairy	0.15 (0.07)	0.28 (0.11)	0.028 (0.02)	0.06 (0.02)
Summer				
Turkey	2.41 (2.51)	2.46 (2.33)	0.11(0.08)	0.33 (0.31)
Swine	0.42 (0.26)	0.64 (0.07)	0.04 (0.02)	0.24 (0.14)
Dairy	0.57 (0.51)	0.88 (1.21)	0.06 (0.06)	0.37 (0.47)

Table 14. PM_{10} emissions (per animal).

	mg/hr/500 kg animal (°C)			
Species	Winter		Summer	
Turkey	135	210	2133	431
Swine	72	76	242	115
Dairy	29	83	5	16

Table 15. PM_{10} emissions (per building area).

	$mg/hr/m^2$			
Species	Winter		Summer	
Turkey	18	28	31	6
Swine	19	21	46	22
Dairy	5	16	109	4

Table 16. Inhalable and respirable emissions (per animal).

	mg/hr/500 kg animal			
Species	Average Winter		Average Summer	
	Inhalable	Respirable	Inhalable	Respirable
Turkey	413	59	9628	332
Swine	211	20	31	19
Dairy	265	56	528	301

Discussion and Implications

Emission estimates of ammonia, hydrogen sulfide and dust were made based on 10-day averages of continuous data. These emission estimates may slightly overpredict actual emissions since no background concentrations of these gases or dust was included in the analysis.

Ammonia emissions during the winter months for all three species were similar ranging from 224 to 273 mg/hr/500 kg live weight for all species. Ammonia emissions during the warm weather were 12,347, 2751, and 481 mg/hr/500 kg live weight for turkey, swine and dairy respectively. This compares with average annual ammonia emissions from Europe of 2208 to 8294 mg/hr/500 kg live weight for broiler facilities, 2398 to 2592 mg/hr/500 kg live weight for swine facilities and 843 to 1769 mg/hr/500 kg live weight for dairy facilities. These differences in emission rates are likely the result of differences in building design, building management, and climate between Minnesota and Europe. In addition, the numbers in this study represent data from only one building of each type.

In the European study and this study, the poultry barns (turkey barns in our case) emitted more ammonia per unit live animal weight than either swine or dairy on an annual basis. These very high emission rates (per unit live weight) from the turkey barn in the summer are likely a result of the low bird weights during the monitoring period (similar emissions per area but smaller bird weights results in a higher emission per live weight of bird). More monitoring would have to be done to verify this hypothesis, however reviewing the data on a per area basis makes this a very likely situation. Because of this, it is necessary to monitor for longer times in any facilities or at a minimum throughout the animals complete growth cycle. The better comparison therefore is between the emission rates per area of building. Comparisons of ammonia emissions on a per area basis suggest summer emissions are greater than winter emissions and that swine facilities generated the highest emission rates per building area—nearly three times higher than turkey and six times higher than dairy. Once again, more data would be needed to verify this trend.

Dust emissions from European data suggest broilers emit the most inhalable and respirable dust followed by swine and dairy and that emissions of respirable dust were far less than emissions of inhalable dust in all cases. Data from this study suggest a similar range dust emissions (Table 2 and Table 16) and a similar trend with the turkey (poultry) facility emitting the most dust inhalable and respirable followed by dairy and swine. However, PM_{10} emission values were higher in the dairy facility than in either the turkey or the swine facilities. This difference in ranking is likely due to building design and possibly the limited amount of data collected in this study. In fact, on one of the two dust monitoring days at the dairy site the freestalls were being bedded with wood shavings that may have resulted in these higher emission values. The process of bedding the freestalls does generate significant amounts of dust therefore annual emissions of dust may be a function of the frequency of bedding and the type of bedding material used. Because of this fact, and similar management practices in the other facilities, long term continuous monitoring will give better estimations of annual emissions.

Hydrogen sulfide emission rates varied from 5 to nearly 550 $\mu g/hr/m^2$. Other published data reported suggest values ranging from 1,000 to 10,000 $\mu g/hr/m^2$ (Ni et al., 1998; Wood et al., 2001). These differences are likely due to the difficulties in ventilation rate measurements in naturally ventilated facilities and differences in measurement and sampling methods. Currently there are no "standard methods" for these types of measurements.

Hydrogen sulfide emissions were highest from the swine facility in the winter on both a per animal weight basis and a per area basis. Summer data could not be compared among these facilities because of the limitations of the hydrogen sulfide monitoring equipment. For the turkey and dairy facilities, emissions of hydrogen sulfide were higher during the summer than winter.

Regulatory considerations include both meeting ambient air quality standards and annual emission rates of Hazardous Air Pollutants (HAPs). In addition, under the Emergency Planning and Community Right to Know Act (Code of Federal Register 40 Chapter J, Section 300) daily emission values are listed for both ammonia and hydrogen sulfide. Along with this, OSHA has established indoor air quality limits for dust, ammonia and hydrogen sulfide. Table 16 summarizes some of the current applicable regulations.

With these regulations in mind, Table 17 was created to show the likely number of animals per site that would emit quantities of gases large enough to possibly meet or exceed the different federal limits. From this analysis, it seems as though ammonia emission may be the most likely constituent restricting the size or triggering reporting requirements of farms with animal number limits of 4200 dairy cows, 8300 finishing pigs, or 69000 turkeys as per the CERCLA requirements of 100 lbs per 24 hours. Note that these animal number estimates do not consider other emission sources on the site such as manure storage structures or land application of manure, so the actual number of animals per farm site that may exceed these limits may be less.

To verify the reasonableness of these measured ammonia emission value found in this study and the animal numbers in Table 17, a nitrogen balance was conducted. The balance compared the amount of nitrogen excreted in the manure and urine to the amount of nitrogen lost through ammonia emissions. These calculations suggest ammonia losses (% of nitrogen excreted in manure and urine and leaving the building as ammonia emissions) from 10-17% for turkey buildings, 12-23% for swine facilities, and 4-7% for dairy facilities. These values are consistent with literature values for loss of nitrogen due to volatilization.

Table 16. Current regulatory standards of potential concern.

Pollutant	Standards
PM_{10}	Ambient concentration of 150 µg/m^3 (0.15 mg/m^3) -24 hour average) National Ambient Air Quality Standard http://www.epa.gov/ttn/atw/pollsour.html 10 tons per year release of any HAP Section 112 of the Clean Air Act www.epa.gov/ttn/atw/pollsour.html
Total Dust	Indoor air concentration 50 mg/m^3 OSHA CFR 29 section 1910 http://www.osha.gov Table Z-3
Respirable dust	Indoor air concentration 15 mg/m^3 OSHA CFR 29 section 1910 http://www.osha.gov Table Z-3
Hydrogen Sulfide	Indoor air concentration (TVL) 20 ppm 8 hour Indoor air concentration (TVL) 50 ppm 10 minute OSHA CFR 29 section 1190 http://www.osha.gov Table Z-2 Minnesota Rules Chapter 7009 30 ppb, 30 minute Release of 100 lbs per 24 hours EPA 40 CFR Chapter 1, Subchapter J, Section 302 100 lbs per 24 hours http://www.access.gpo.gov/nara/cfr/ http://www.epa.gov/ceppo/ep-epre.htm http://www.epa.gov/docs/epacfr40/chapt-I.info/subch-J.htm
Ammonia	Indoor air concentration (TVL) 50 ppm 8 hour OSHA CFR 29 section 1190 http://www.osha.gov Table Z-1 Release of 100 lbs per 24 hours EPA 40 CFR Chapter 1, Subchapter J, Section 302 100 lbs per 24 hours http://www.access.gpo.gov/nara/cfr/ http://www.epa.gov/ceppo/ep-epre.htm http://www.epa.gov/docs/epacfr40/chapt-I.info/subch-J.htm
Multiple HAP	25 tons per year released Section 112 of the Clean Air Act www.epa.gov/ttn/atw/pollsour.html

Table 17. Estimates of animal numbers per site that would meet or exceed federal emission standards (10 tons per year or 100 lbs per day) based on emission data from this study.*

Species	Estimated animal density ft^2/animal	Estimated # animals per site to exceed Annual emission standards (24 hr emission standards) Ammonia[1]	Hydrogen Sulfide[1]	PM10[2]
Turkey	2.8	38,000 (69,000)	260 M (470 M)	192,000 (350,000)
Swine	8.1	4550 (8300)	15 M (30 M)	50,000 (92,000)
Dairy	72.8	2300 (4200)	0.5 M (1 M)	4600 (8400)

[1] 24-hour standard are currently applicable
[2] Both 24-hour and annual standards are currently applicable.

*Note: These animal numbers are based on average emission estimates from this study. More data would need to be collected to verify these emission rates and estimated animal numbers. In addition, since emission rates fluctuate widely day to day the24-hour, 100 lb., reporting may be required at lower animal numbers.

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Report Two

Correlation of Odor with Air and Manure Chemistry

Final Report
Submitted to the Environmental Quality Board (GEIS)
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Introduction

Determining the amount of odor emitted from a livestock building or manure storage is extremely challenging and very expensive. Odor measurement is necessary to assess the effectiveness of odor control technologies and assess the odor impact of livestock and poultry facilities on the surrounding community. Currently the most reliable and accepted method for measuring odor is using olfactometry. Olfactometry is a system of quantifying odors based on the human olfactory system and uses human subjects to assess the strength of the odor. Olfactometry is the most accepted method for assessing odor yet the reliability of odor measurements using olfactometry is often questioned because it is regarded as a subjective measurement method (Zahn et al., 1997). Therefore, because of subjectivity and high cost of olfactometry it is desirable to investigate alternative methods to quantify odors.

One alternative method to the measurement of odor using olfactometry is the measurement of the odorous gases that contribute to this odor. Several researchers have done extensive work documenting odorous compounds in both manure and in the air near swine buildings, swine manure storages and swine lagoons. Some of the most likely odorous volatile organic compounds (VOCs) and their relative concentration are listed in Table 1. Unfortunately, although individual gases comprise these odors and the physical and chemical parameters of the manure determine the release and composition of these gases, the relationship of these gases to the actual human sensation of odor remains elusive (Ostojic and O'Brien, 1995; Zahn et al., 2001a).

The objective of this project was to compare odor concentration, as measured with olfactometry, to the physical and chemical characteristics of the manure and the odorous gases in the air sample. Any correlation found between these measurements would be beneficial to regulators, researchers, and producers.

Table 1. Chemicals most thought to contribute to swine odor (Zahn, 1997)

Compound	Concentraion in air (mg/m^3)	Odor Characteristics
Hydrogen sulfide	0.090	Rotten eggs
Ammonia	3.700	Sharp, pungent
Dimethyl disulfide	0.170	Putrid, decayed vegetables
2-Butanol	0.019	Alcohol
Dimethyl trisulfide	0.013	Nauseating
Acetic acid	0.270	Pungent
Propionic acid	0.130	Fecal
Isobutyric acid	0.110	Fecal
Butyric acid	0.590	Fecal, stench
Isovaleric acid	0.098	Fecal
n-Valeric acid	0.360	Fecal
Isocaproic acid	0.010	Stench
n-Caproic acid	0.110	Fecal
Heptanoic acid	0.008	Pungent
Benzyl alcohol	0.002	Alcohol
Phenol	0.025	Aromatic
4-Methyl phenol	0.090	Fecal
4-Ethyl phenol	0.004	Pungent
2-Amino acetophenone	0.001	Fruity, ammonia
Indole	0.002	Fecal
3-Methyl indole	0.002	Fecal, nauseating

Methodology

Air samples from thirty different sources (both manure storages and barns) were collected using either a wind tunnel (for manure surfaces) or from the exhaust air of a building. Samples were collected from poultry, swine, dairy and beef facilities. Air samples were collected in 10 liter Tedlar bags using a vacuum box. Within minutes after collection, the air in the Tedlar bag was tested for hydrogen sulfide using a Jerome Hydrogen Sulfide Analyzer (Model 631-X, Arizona Instrument, Phoenix AZ). The Tedlar bag was then transported to the University of Minnesota Olfactometry Lab and evaluated for odor concentration using standard olfactometry procedures (CEN #13725). During the time the air sample was being collected in the Tedlar bag, part of the air sample was diverted to a second sampling system. This air traveled through a glass gas bulb where SPME (Solid Phase Micro Extraction) fibers (Supelco SPME Portable Field Sampler, Supelco, Bellefonte, PA) used for collecting the volatile organic compounds (VOCs) were exposed to the air stream for a 20 minute period. The air was then routed via teflon tubing to a boric acid trap for collection of the ammonia in the air stream. The SPME fibers were then placed in a cooler and shipped to Iowa State University, Department of Animal Science to be evaluated via gas chromatography/mass spectrometry (GC/MS) for VOCs (Table 2). This SPME sampling methodology is described by Koziel et al. (2001) and Gralapp et al. (2001). The boric acid solution was cooled and returned to the University of Minnesota Odor Laboratory for titration to determine the ammonia concentration.

Manure samples were also collected from these same odor sources. Samples were frozen and sent to Minnesota Valley Testing Laboratories for evaluation of the following: total solids, volatile solids, COD pH, total phosphorus, ortho-phosphorus, total potassium, ammonia nitrogen, TKN, zinc, conductivity, sulfate, total dissolved sulfide, magnesium, total sulfur, and sulfide and different VOCs (Table 3). Duplicate manure samples were sent to Iowa State University, Department of Animal Science for analysis of VOCs (Table 2) using a GC/MS. Ambient weather conditions, temperature, wind speed, wind direction and sky conditions were also monitored during sample collection.

A statistical evaluation was conducted to determine any correlation between the odor concentrations and the chemical composition of the manure and air.

Table 2. Listing of volatile organic compounds analyzed for both air and manure samples at Iowa State University.

acetic acid, propionic acid, 2-methylpropanoic acid, n-butyric acid, 3-methylbutanoic acid (*i*-valeric), pentanoic (*n*-valeric), phenol, 4-methylphenol (*p*-cresol), 3-methylphenol (*m*-cresol), 4-ethylphenol, 3-ethylphenol, 2(1,1)phenol, indole, 3-methyl indole (skatole), 2-methyl indole, carbondisulfide, ethanethiol, butyrolactone, decane, nonadecane, nonanal, undecane, dodecane, dimethylamine, dimethyl disulf, pentane, nonane, 1decene, tridecane, tetradecane

Table 3. Listing of manure sample characteristics evaluated at MVTL labs.

%total nitrogen, %phosphorus, %potassium, ammonia nitrogen, %total solids, %total volatile solids, pH, sulfate, chemical oxygen demand, magnesium, zinc,

%organic nitrogen, sulfur, total sulfide, soluble sulfide, conductivity, orthophosphorus

Results and Discussion

Manure characteristics and chemistry

Forty-one manure/air samples were collected specifically for this study. These forty-one samples were combined with another forty samples from a similar study funded by the National Pork Board in order to increase the data set for statistical analysis. Unfortunately, even with the larger data set, no statistical correlation could be found between the odor concentrations and any manure chemistry or characteristics. This lack of good correlation seems reasonable because of the wide variety of odor sources sampled in this study. For example, some of the sources had geotextile or natural crust covers. As is always the case with air sample collection, the sample was collected above the cover or crust and the manure sample was collected below the cover or crust. Because of this, it is reasonable to expect that the manure chemistry (below the cover) might have little to do with the odor emissions above the cover. Instead, it is reasonable to expect that the odor concentration is a function of both the manure chemistry and the type of cover. Similarly, the manure samples collected from deep pitted barns will likely have limited correlation to the chemistry of the air sampled from the barn exhaust since there is the likelihood that other odorous gases generated in the barn would also contribute to the air sample but not be part of the manure sample. Also, the manure characteristics are not necessarily directly comparable to the emission rate of these compounds since the emission rate is a function of the manure chemistry AND the ambient conditions at the time of sampling.

Therefore to simplify the analysis, a subset of data using only those data points from uncovered, uncrusted manure storages using a wind tunnel was reviewed. This data is presented in Table A-1, Appendix A. Even in this relatively similar data set, no correlation was found between odor and manure chemistry. Also noteworthy is the large range in values of the different VOCs and the absence of some notable compounds often cited in literature as predominate in swine manure odor and the prevalence of several compounds from the alkane family not typically shown in literature. Currently there is no logical explanation as to the absence or presence of these chemicals in some of the samples.

Air Chemistry and Odor

Comparisons of air concentrations of VOCs to odor concentration seem to be the most logical comparison to make. With this comparison there is no confounding parameters such as air treatment or environmental parameters that affect the relationship of manure chemistry to chemical volatilization rate. The comparison is strictly between the odor concentration and the chemical concentrations in the air sample.

Unfortunately, most of the odorous chemicals typically found in odorous air from swine facilities (Table 1) were not detected in these air samples. One possible explanation is the differences in sampling methodology used to generate the concentrations in Table 1 and the concentrations determined in this study. In this study, VOCs were captured and concentrated using Solid Phase Micro Extraction (Gralapp et. al., 2001; Koziel et. al., 2001). Table 1 was generated using adsorption tubes packed with Tenax TA and Carboxen-596 (Supelco, Bellefonte, PA) (Zahn et al., 1997). Current debate is still being waged over the potential differences in these two measurement techniques (Zahn, 2002; Powers, 2002; Bicudo 2002).

One general category of compounds, alkanes, were detected in nearly all the samples evaluated. Alkanes have not been reported in most literature and may be residual compounds from the wind tunnel sampling method (Zahn, 2001). However, alkanes also were detected in the manure samples (which would not have been impacted by any residual in the wind tunnel). Even so, it is unlikely that alkanes have any impact on odor since these compounds have a high odor threshold (takes significant concentrations of the chemical before it can be detected by the human olfactory system) nor are known for fecal smells associated with manure (Eaton, 1996).
Some comparisons were made between the odor concentrations and hydrogen sulfide (Figure 1), ammonia (Figure 2) and total VOC measurement (Figure 3) in the air samples. These graphs indicate some correlation between odor and hydrogen sulfide but none between odor and ammonia or odor and the total VOCs. (Note: total VOC measured is the sum of all the volatile organic compounds that were measured in the sample including the alkanes.) In all of the data collected, there was no obvious differences between odor from different animal species (swine, dairy, beef, and poultry), however, some differences may be found with a larger data set or alternative sampling and measurement techniques.

Discussion and Implications:
The lack of correlation between odor and manure chemistry or air chemistry suggests that 1) the methodology for sampling and chemical analysis of manure samples and air samples may not be accurate or sensitive enough, 2) olfactometry methods to determine odor concentrations are too inconsistent, or 3) the complexity of the human response to odorous gases is more complex than current analytical techniques can provide. This third assumption is supported by a variety of researchers in the odor measurement field (Ostojic and O'Brien, 1995). Repeatedly, these investigators have attempted to correlate the air chemistry to human olfactory response in regard to municipal and industrial odors with no success. These researchers suggest that the odorous gases are present in concentrations below the detection threshold of the analytical equipment but can be detected by the human olfactory system, and the synergistic effects of multiple compounds is nearly impossible to quantify due to the number of compounds found in these odor sources. However, limited data by Zahn et. al., 2001 may suggest that some correlation between odor *intensity* or odor *characteristics* (vs. odor concentration) and analytic chemistry might be possible with similar manure types (e.g. swine manure) stored in a similar manner (outdoor manure storage).

The results of this study suggest that the best “indicator” of odor may be the air concentration of hydrogen sulfide, however, even this correlation is limited and needs further investigation.

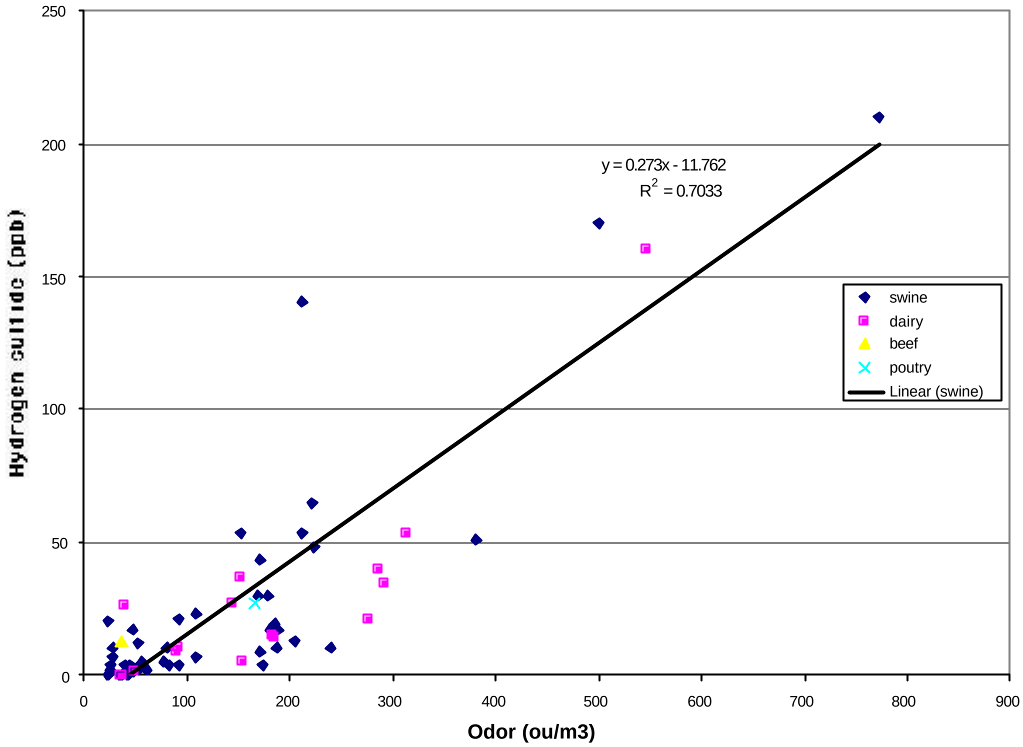

Figure 1. Odor concentration vs. hydrogen sulfide concentration in the air.

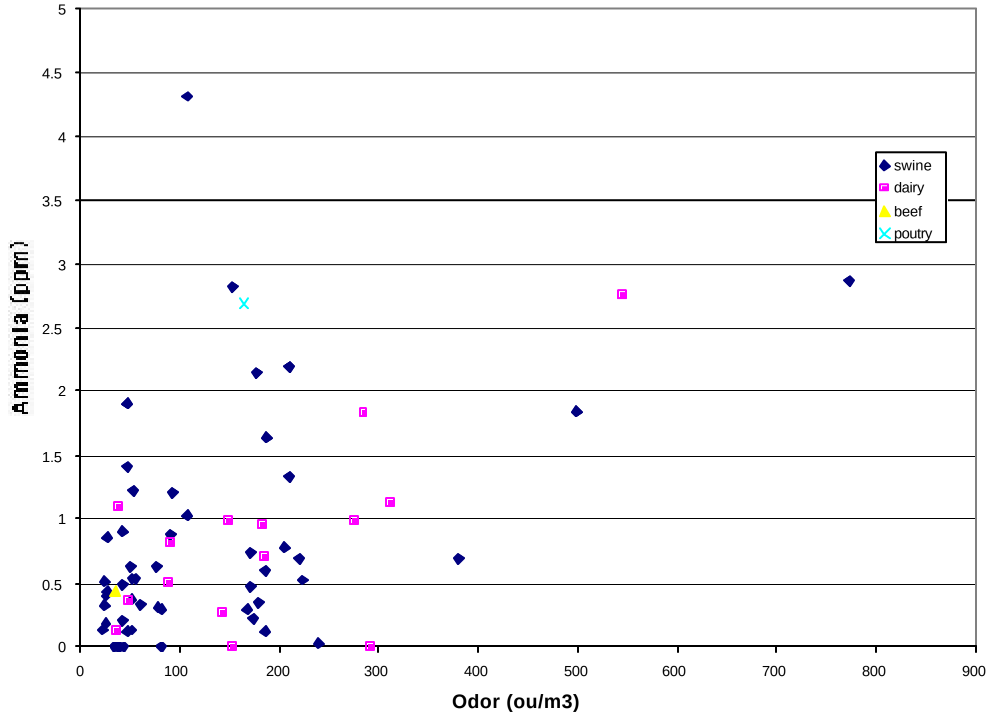

Figure 2. Odor concentration vs. ammonia concentration in air.

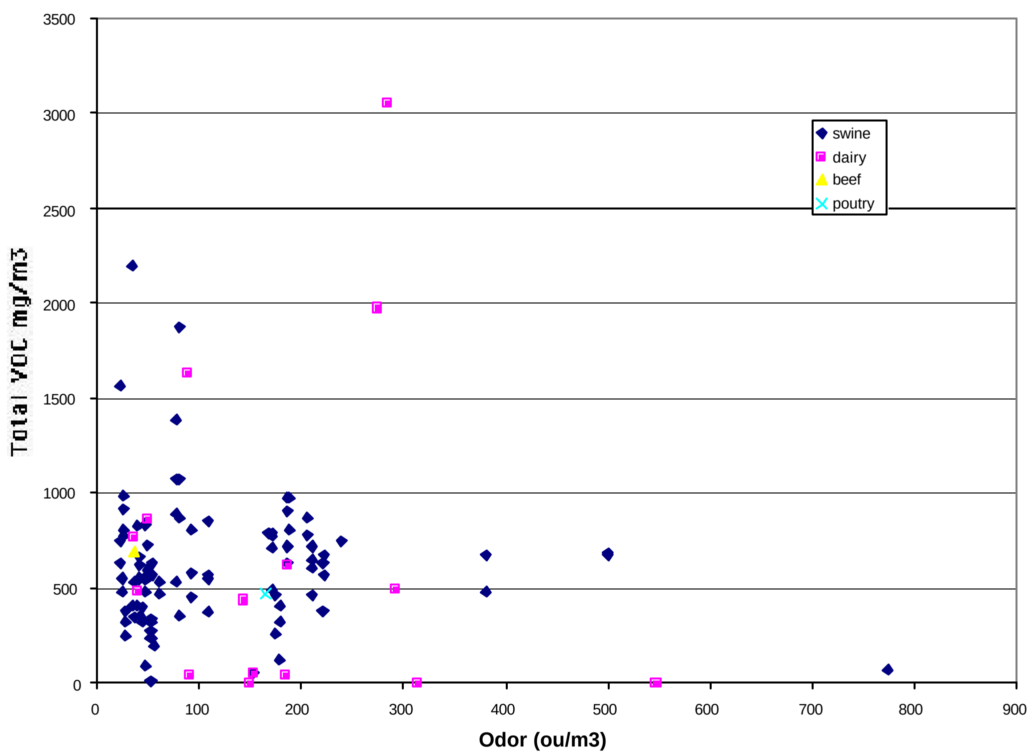

Figure 3. Odor concentration vs. air VOC concentration

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Appendix A

Table 1. Odor threshold vs. manure chemistry for uncovered manure storages.

Odor threshold (OU)	Species	H2S (ppb)	NH3 (ppm)	Temp (C)	Field pH	Total Nitrogen (%)	Phosphorus (%)	TotSolids (%)	TotVolSolids (%)	Lab pH
28	swine	7	0.9	18.8	7.79	0.16	0.03	0.72	45.5	7.98
42	swine	2	0.9	31.5	7.68	0.14	0.02	0.77	41.7	8.08
74	dairy	19		24.7	7.42	0.22	0.09	2.9	72.7	7.46
81	swine	10	0.0	17.0	7.48	0.2	0.03	0.8	30.8	7.81
108	swine	23	4.3	27.0	7.69	0.14	0.03	0.81	23.1	7.98
144	dairy	27	0.3	17.1	6.9	0.25		2.86	70.5	
150	dairy	37	1.0	18.4	7.69	0.34		4.93	70.1	
170	dairy			24.7	7.63	0.2	0.09	2.14	64.7	7.69
171	swine	43	0.5	24.6	7.85	0.14	0.02	0.73	33.3	8.09
186	swine	19	0.6	22.0	7.68	0.18	0.03	1.06	31.2	7.98
186	dairy	14	0.7	24.7	7.63	0.2	0.09	2.14	64.7	7.69
188	swine	17	1.6	25.6	7.52	0.17	0.03	0.83	46.2	8.02
221	swine	65	0.7	18.1	7.85	0.19	0.03	0.77	25	8.3
223	swine	48	0.5	23.0	7	0.29	0.05	1.97	51.6	7.44
240	swine	10	0.0	15.5	6.3	0.15		1.15	72.2	
292	dairy	34		24.7	7.42	0.22	0.09	2.9	72.7	7.46
312	swine	42		15.4	7.12	0.14		0.32	40	
380	swine	51	0.7	18.6	7.7	0.22	0.03	0.81	23.1	8.18
499	swine	170	1.8	23.0	7.51	0.17	0.03	0.78	41.7	7.96

Table 1. Odor threshold vs. manure chemistry for uncovered manure storages. (Continued)

Odor threshold (OU)	Sulfate mg/kg	ChemOxyDemand mg/kg	Magnesium mg/kg	Zinc mg/kg	%OrgNitrogen	Sulfur mg/L	TotSulfide mg/L	SolSulfide mg/L	Conductivity µmhos/cm	OrthoP mg/L
28	178	3900	26.4	24	0	42.3	42.4	21.7	13200	51.5
42	412	5500	49.2	7	0.02	46.6	25.1	16.4	13500	51.9
74	2430	35000	369	9	0.09	126	140	57.7	17900	252
81	417	6150	55.7	6	0.06	60.6	38.4	21.7	13000	58.8
108	511	6300	55.8	8	0.02	44.1	38	21.3	13900	83.3
144	2560	21400				140	51.1	7.1		
150	3610	22900				143	56.4	42.4		
170	2010	22400	324	8	0.08	111	129	48.4	12200	272
171	694	4550	42.6	5	0.01	50.9	131	28.4	14100	32.3
186	625	6500	43.6	38	0.02	57.4	61.7	55.1	16100	80.4
186	2010	22400	324	8	0.08	111	129	48.4	12200	272
188	641	5750	42	34	0.02	57.4	55.1	32.4	15300	87
221	370	2700	25.7	23	0.03	52.1	15.7	13.2	13900	46
223	1140	34000	127	7	0.03	134	36.7	34	21400	153
240	1360	18000				229	3.1	1.1		
292	2430	35000	369	9	0.09	126	140	57.7	17900	252
312	568	1600				39	8.4	7.1		
380	278	2600	58.8	7	0.03	60.6	13.7	13.2	13300	47.1
499	511	5800	40.2	29	0.02	59.2	25.3	22	16500	86

Table 1. Odor threshold vs. manure chemistry for uncovered manure storages. (Continued)

Odor threshold (OU)	Acetic acid ppm	Propionic acid ppm	2-methylpropanoic acid ppm	n-butyric acid ppm	i-valeric acid ppm	n-valeric acid ppm	Phenol ppm	p-cresol ppm	m-cresol ppm
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.148	0.000
74	0.000	0.000	0.000	0.000	0.000	0.000	11.908	25.658	14.382
81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.772	5.181
108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.970	5.942
144	212.720	32.393	0.000	0.000	0.000	0.000	13.401	18.053	2.757
150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	0.000	0.000	0.000	0.000	0.000	0.000	2.420	0.263	0.000
171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.214	0.082
186	0.000	0.000	0.000	0.000	0.000	0.000	0.740	0.216	2.499
186	0.000	0.000	0.000	0.000	0.000	0.000	2.420	0.263	0.000
188	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.270	0.000
221	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.590	0.000
223	3111.492	1015.099	127.752	218.155	35.246	12.375	13.262	50.019	282.924
240	400.098	140.127	0.000	147.567	0.000	0.379	29.840	6.648	3.993
292	0.000	0.000	0.000	0.000	0.000	0.000	11.908	25.658	14.382
312	0.000	0.000	0.000	0.000	0.000	0.000	0.914	0.821	0.000
380	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.484	0.000
499	0.000	0.000	0.000	0.000	0.000	0.000	0.307	0.958	0.000

Table 1. Odor threshold vs. manure chemistry for uncovered manure storages. (Continued)

Geomean DT	4-ethyl phenol ppm	3-ethylphenol ppm	2(1,1)phenol ppm	Indole Ppm	Skatole ppm	2-Methylindole ppm	Carbon disulfide ppm	Ethanethiol ppm	Butyrolactone ppm	Decane ppm
28	0.052	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.133	2.288	0.000	0.000	0.000	0.000	0.000
74	1.644	0.000	0.000	1.083	1.544	0.000	0.000	0.000	0.000	0.000
81	0.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
108	0.880	0.000	0.000	0.326	1.253	0.000	0.000	0.000	0.000	0.000
144	0.502	0.000	0.000	0.061	0.371	0.000	0.000	0.000	0.000	0.000
150	0.000	0.000	0.007	0.000	3.054	0.000	0.000	0.000	0.000	0.000
170	0.246	0.000	0.000	0.276	2.285	0.000	0.000	0.000	0.000	0.000
171	0.359	0.000	0.000	0.163	2.773	0.000	0.000	0.000	0.000	0.000
186	0.181	0.000	0.000	0.557	3.558	0.000	0.000	0.000	0.000	7.948
186	0.246	0.000	0.000	0.276	2.285	0.000	0.000	0.000	0.000	0.000
188	0.029	0.018	0.000	0.035	0.000	0.000	0.000	0.000	0.000	0.000
221	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
223	3.806	0.000	0.000	0.364	0.946	0.000	0.000	0.000	0.000	0.000
240	0.294	0.000	0.000	0.319	0.213	0.000	0.000	0.000	0.000	0.000
292	1.644	0.000	0.000	1.083	1.544	0.000	0.000	0.000	0.000	0.000
312	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
380	0.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
499	0.132	0.000	0.000	0.792	1.971	0.000	0.000	0.000	0.000	0.000

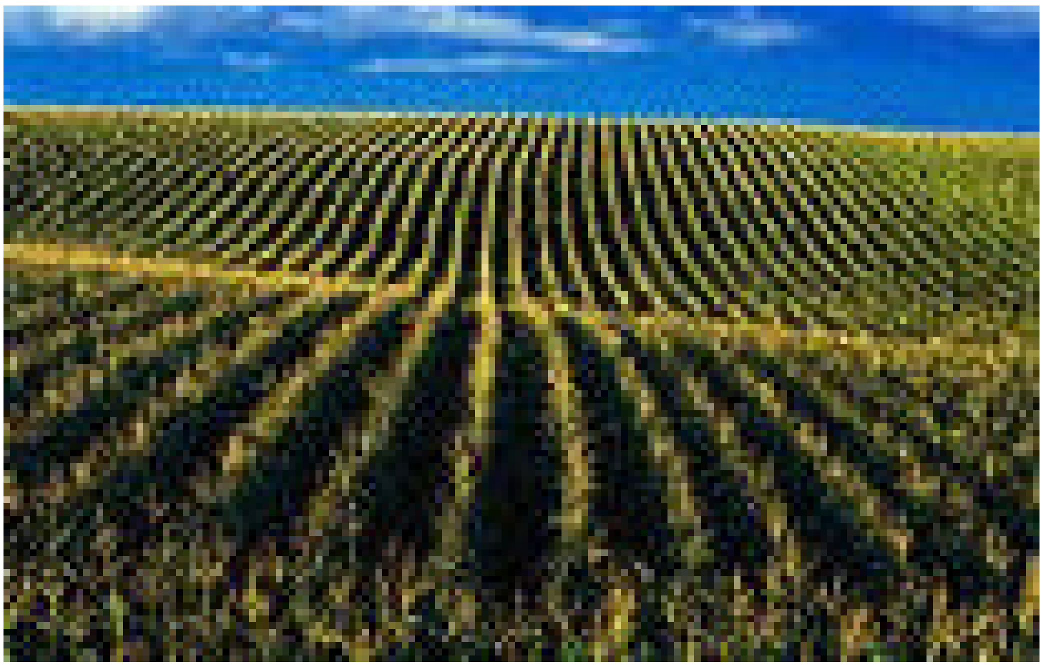
Table 1. Odor threshold vs. manure chemistry for uncovered manure storages. (Continued)

Geomean DT	Decane ppm	Nonadecane ppm	Nononal ppm	Undecane ppm	Dodecane Ppm	Dimetamine ppm	Dimethyll disulfide ppm	Pentane ppm	Nonane ppm	1decene ppm	Tridecane ppm	Tetradecane ppm
28	0.000	0.000	0.000	3.214	9.279	0.000	0.000	0.000	0.000	0.000	5.111	3.064
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.000	0.000	0.000	0.000	54.416	0.000	0.000	0.000	0.000	0.000	72.471	75.626
81	0.000	0.000	0.000	0.000	26.175	0.000	0.000	0.000	0.000	0.000	13.282	9.858
108	0.000	0.000	0.000	0.000	8.961	0.000	0.000	0.000	0.000	0.000	29.156	33.754
144	0.000	0.000	0.000	0.000	88.823	0.000	0.000	0.000	0.000	0.000	77.469	56.580
150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.273	3.476
170	0.000	0.000	0.000	0.000	14.712	0.000	0.000	0.000	0.000	0.000	32.032	46.679
171	0.000	0.000	0.000	12.523	47.117	0.000	0.000	0.000	0.000	0.000	58.827	60.516
186	7.948	0.000	0.000	135.959	88.089	0.000	0.000	182.725	0.000	4.675	64.726	45.362
186	0.000	0.000	0.000	0.000	14.712	0.000	0.000	0.000	0.000	0.000	32.032	46.679
188	0.000	0.000	0.000	0.000	3.039	0.000	0.000	0.000	0.000	0.000	3.917	5.499
221	0.000	0.000	0.000	4.845	2.291	0.000	0.000	0.000	0.000	0.000	0.000	0.000
223	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
240	0.000	0.000	0.000	0.000	92.444	0.000	0.658	0.000	0.000	0.000	143.697	118.113
292	0.000	0.000	0.000	0.000	54.416	0.000	0.000	0.000	0.000	0.000	72.471	75.626
312	0.000	0.000	0.000	0.000	13.064	0.000	0.000	0.000	0.000	0.000	46.185	39.295
380	0.000	0.000	0.000	0.000	1.975	0.000	0.000	0.000	0.000	0.000	0.000	0.000
499	0.000	0.000	9.892	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.335

Appendix H

Minnesota Phosphorus Site Risk Index

Technical Guide



A final report to:

The Minnesota Environmental Quality Board
Generic Environmental Impact Statement

June 30, 2002

Minnesota Phosphorus Site Risk Index

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EXECUTIVE SUMMARY

Surface water quality is an important issue in a state where this resource provides a major economic engine. Phosphorus can be a major factor in lake eutrophication. Phosphorus (P) is the nutrient limiting algae growth in most fresh water systems. When P in runoff is allowed to enter surface waters the resultant algal bloom results in depleted dissolved oxygen levels and the associated degradation in water quality. Phosphorus is also an important plant nutrient. Fertilizer, manure, and other organic P sources are land applied to support adequate plant growth. The challenge that people who make land use decisions have is to balance economic and environmental risks.

The Minnesota Phosphorus Index is a management tool for individual fields or landscapes that provides a relative (unitless) assessment of the risks to surface waters of P losses from erosion, rainfall runoff and snow melt runoff. It also allows the user to evaluate management options that can reduce the risk. It is not intended to be used as a regulatory tool, or to estimate changes in P from water quality monitoring. The Minnesota P Index does not consider the sensitivity of the receiving waters. It doesn't consider the environmental costs of entry of P to surface waters. It also doesn't consider the cost of adoption of different practices to reduce P losses from specific fields.

Other states have developed similar tools. As with other states, Minnesota's P Index addresses its unique climate, soils, landscapes, and land use practices to develop a risk assessment. For example, it is currently the only index that assesses the risk associated with snowmelt P losses. This would have little value in Florida or Texas but in Minnesota it can be a major source of P entering surface waters. All current indices assess P source levels and the probability of transport across the landscape. A detailed

review of the literature can be found in the more detailed documentation to the Minnesota P Index.

There are two basic approaches to P indices, the matrix method and the pathway method. The matrix method uses a matrix of rows that represent source and transport issues and columns that represent different levels of risk. Weighting factors for source, transport, and P loss risk are assigned to different practices based on the opinion of experts. Often the risk increases by doubling as you move from one level to the next. The matrix model was considered during the development of the Minnesota P Index and was also used to estimate risk on a regional scale (Birr and Mulla, 2001). A second, less common approach is the pathway model. This is a more physically based model using algorithms from published data that estimate P source levels and risk of transport across the landscape to surface water. Multiple pathways are assessed and added to yield an overall risk. This is the approach that was chosen for the Minnesota P Index.

There are three pathways considered in the Minnesota pathway approach. The first is P associated with the erosive loss of sediment from rainfall. The second is P associated with rainfall runoff. The third is P loss associated with snowmelt runoff. Losses from these three pathways are added, giving a total P index (unitless) for the given site. These losses represent the relative risk of P losses for a given site and set of management practices, and are typically larger than actual losses. For this reason, the Minnesota P index should not be compared with or used to estimate watershed scale water quality monitoring data.

Evaluation of test scenarios revealed that there are multiple ways to lower the P Index. Best management options can be evaluated for a specific site using the Minnesota P Index. P losses can be lowered using some combination of reduced P application rates, improved methods of P application, or adoption of practices such as conservation tillage or buffer strips that reduce the risk of P transport across the landscape. Usually one pathway (erosion, rainfall runoff, or snowmelt runoff) is more important than other pathways, and management changes that address that pathway are the most effective method for reducing the overall risk.

TABLE OF CONTENTS

Introduction

Environmental policies of the past three decades have significantly reduced the amount of phosphorus entering surface waters from point sources. However, eutrophication of fresh waters due to transport of excessive amounts of phosphorus from non-point sources such as municipal and agricultural activities is still a major environmental concern.

Phosphorus is an economically important input in both crop and livestock production systems (Mallarino and Blackmer, 1992; Valk et al., 2000). A challenge in agriculture is to supply adequate P for economical production while minimizing losses to surface and ground water. Application of phosphorus in fertilizer and manure in excess of the quantities removed by crops has elevated phosphorus levels in many agricultural soils above agronomically optimum levels. Runoff and erosion from these soils can transport phosphorus into surface waters if there is a hydrological connection.

Recognizing the fact that high phosphorus soils can contribute to eutrophication of surface waters, many states have established threshold soil test phosphorus levels that limit application of additional phosphorus in soils exceeding the threshold (Sharpley et al., 1996). However, using agronomic soil phosphorus measurements to make water quality recommendations is not generally accepted. Further, the movement of phosphorus from agricultural soils to water bodies is influenced by many factors and a more holistic approach is needed for protection of vulnerable water bodies. In response to that need, a group of researchers from universities and government agencies in the early 1990's developed the concept of a phosphorus site index.

The concept of a phosphorus site index is to assess the risk of off-site P movement from fields or watersheds using a combination of landscape and land management factors (Birr and Mulla, 2001; Gburek et al., 2000, Lemunyon and Gilbert, 1993). The factors consider sources of P as well as transport of P to water. The original phosphorus index has been shown to relate to off-site transport of phosphorus from small agricultural watersheds in Texas, Oklahoma, and other regions (Sharpley, 1995). Modified versions of the original phosphorus index have been used by many states and governmental agencies to apply to local climate and land management conditions. A phosphorus index developed for Minnesota will be an important means of accomplishing water quality goals by focusing resources and efforts on areas with the highest potential for transport of phosphorus to surface waters.

Development Process

A team of individuals from the University of Minnesota, the USDA-ARS, the USDA-NRCS, and the Minnesota Pollution Control Agency worked together for approximately 18 months to develop the Minnesota P site index. The development process involved the following steps.

- P Index literature review
- Establishment of Soil Critical Levels
- The MN P Index Description
- Testing and Evaluation
- Sensitivity Analysis
- Professional Review
- Field Pilot Testing

Phosphorus Index Literature Review

The purpose of the literature review was to provide background on the development of the various phosphorus indices used or being developed in the US. We evaluated eight P site indices (details in Appendix A). From this critique, we chose the factors used for computing site risk that have relevance for Minnesota conditions (Table 1).

Among the indices evaluated there were two distinct approaches in the way the index is formatted. The majority of the indices use a matrix approach, with rows representing risk factors and column representing categorical risk levels. The other approach makes a quantitative estimate of the phosphorus loss from a site.

The original matrix phosphorus index was based on the concept that phosphorus loss from agricultural land is governed by the combination of "source factors" and "transport factors" (Lemunyon and Gilbert, 1993). Each factor was assigned a weight based on expert opinion. The factors and respective weight from the original P index are:

Source Factors: agronomic soil test phosphorus (1.0), inorganic phosphorus application rate (0.75) and method (0.50), organic phosphorus application rate (1.0) and method (0.5).

Transport Factors: soil erosion (1.5), irrigation erosion, runoff class (0.5).

Although there have been many versions of the P index developed, most use the same core factors to evaluate risk as the original version. Some indices use additional factors that are of local importance. Most indices have included a term to account for proximity of the field to surface water. The authors of the original phosphorus index acknowledged the need for individual states to modify the index and its algorithms for specific uses or locations.

The various P indices differ widely in how factors are weighted and in how risk is computed. Many states have modified the original index by combining source and transport factors in a multiplicative approach rather than the original additive approach. No uniform scale has been developed for phosphorus indices, which complicates direct comparison of the various approaches. In most indices, the outcome is a relative level of the risk of off-site phosphorus transport. Iowa, however, used a different approach in developing an index. In the Iowa index risk is computed using a pathway model. This is a more physically based model where algorithms are developed using published data that estimate P source levels and risk of transport across the landscape to surface water. The Iowa index is the computed index value of an estimate of phosphorus delivery (lb/ac) rather than a relative risk level.

We initially considered both a matrix approach and a pathway approach. Although there are advantages and disadvantages to each, a modified pathway approach (unitless) was selected as best for use in Minnesota.

In addition to risk factors used in other P indices, we identified unique factors of importance for evaluating P transport in Minnesota. Specifically, we included a snowmelt runoff factor and an incorporated manure factor.

Characterization of Phosphorus in Minnesota Soils

An extensive characterization of P in Minnesota soils was performed to establish criteria of risk for use in the Minnesota P site index. Specifically, relationships were developed between soil test P and the concentrations of soil total P and soluble P in runoff water.

The characterization was accomplished through a combination of a laboratory extraction studies and a simulated rainfall study using the surface horizon of more than 160 agricultural soils from across Minnesota. Soils represented major agricultural regions and cropping systems in the state (Figure 1).

Soil samples were analyzed for pH, Bray P, Mehlich P, and Olsen P, total P, soil texture, soluble P, phosphorus sorption capacity, organic matter and calcium carbonate equivalent.

A subset of 38 of the soils was used for a simulated rainfall study. The protocol for the runoff study was modified from the USDA-NRCS national phosphorus project protocol. Soils were dried, sieved, and then packing into 60 x 15 x 10-cm PVC boxes. Prior to applying rainfall, soil was saturated from the bottom using a Marriott bottle apparatus. The boxes were adjusted to a uniform slope of 4%, typical of much of the landscape in Minnesota. Rainfall was applied for 30 min at a rate of 6 cm hr^{-1}, the average 30-min rain intensity with a 5-year return frequency in Minnesota. Deionized water was used as the source water for the rainfall simulator. Runoff from each soil sample for an entire rain event was composited in an acid-washed 3-L plastic container. A 50-mL aliquot was immediately filtered through a 0.45 um syringe filter unit and stored at 4 ^{o}C for analysis of soluble P. The unfiltered runoff was stored at 4 ^{o}C and later analysed for biologically available phosphorus (Fe-strip method), total P, and total suspended sediment.

Critical results of the soil characterization that were used in the P Index are summarized in Appendix B. These include correlations between various Olsen P and Bray P, Olsen P and Mehlich P, Olsen P, and Total P, and Olsen P and Runoff Soluble P.

The Minnesota P Index Description

The Minnesota P Index is developed based on the concept of independent pathways of P delivery from a field to water. The index combines input factors within each pathway to compute a risk score. The three pathways considered are 1) sediment-bound P from rainfall runoff, 2) soluble P from rainfall runoff, and 3) soluble P from snowmelt runoff.

I. Sediment-bound P, Rainfall

Calculations in this pathway estimate the risk of P losses from a field to water by erosion transport processes. Each step in this pathway is described here.

Sheet and rill erosion. The long-term average annual soil loss is estimated using the Revised Universal Soil Loss Equation, RUSLE (USDA-NRCS, 1996a) or RUSLE2 (USDA-NRCS, 2002). The estimate is based on soil type (K factor, erodibility), climatic erosivity (R, amount and intensity of rainfall), slope length and steepness (LS), cover management practices (C), and support practices that reduce erosion (P). Soil type and topography vary across most fields, but often a critical part of the field can be identified that is most subject to soil loss. RUSLE calculations should be based on this "critical area". The impacts of wind erosion are not currently accounted for in the Minnesota P Index.

Manure factor. Field monitoring data in Minnesota and elsewhere have shown that applied manure (incorporated or injected) reduces erosion when compared to soils without manure (Gilley and Risse, 2000). However, RUSLE estimates are not sensitive to this reduction. Thus, for the Minnesota P Index, a Manure Factor (for manure applied within the last 3 years) is used to modify the soil erosion estimate. The erosion prediction is reduced by 25% (multiply by 0.75) if manure was injected or incorporated during the previous 3 years. Literature reports suggest the reduction in erosion after applied manure could range from zero to as much as 75%, with the majority of reports showing reductions of 25-50%. Thus, a 25% percent reduction was chosen as a representative, but conservative estimate. Erosion rates in the Minnesota P Index are <u>not</u> reduced in response to surface applications of manure, these adjustments can be handled using RUSLE.

Sediment Delivery. **The mass of eroded sediment and associated particulate P that is transported to water depends on the degree of deposition before it reaches water. In this step, the soil erosion estimate is modified to account for deposition of sediments that occurs before reaching the nearest surface water body (perennial and intermittent streams, lakes and protected wetlands, and drainage ditches) or surface tile inlet. Deposition may occur in features such as retention ponds, surface inlets, vegetative buffer strips, etc. If any of these features exist, then a** Sediment Trap Factor **is used to represent deposition. A table of Sediment Trap Factors is provided. Values in the table are obtained from published literature or technical guides (Ginting et al., 2000; Gieseke, 2000, USDA-NRCS, 1996b; Robinson et al., 1996; Munoz-Carpena et al., 1993; Dillaha et al., 1989; and Tollner et al., 1976, Iowa NRCS, 2001). When no sediment retaining features are present, then sediment deposition is calculated using a** Sediment Delivery Ratio (SDR)**, which is estimated based on the distance from field edge to surface water. The relationship between distance and SDR was obtained from Ouyang and Bartholic (1997).**

Sediment Total P Concentration. The concentration of total P associated with delivered sediment is estimated from native soil P levels and soil test P concentration determined within the past 3 years. The effect of soil test P on native soil P levels is accounted for a regression equation that was developed from over 160 soil samples taken from agricultural fields in Minnesota (Appendix B). Soil test P determined by the Olsen method is well correlated with total soil P and is used to predict total P concentration. However, when a Bray or Mehlich test is already available, a separate Olsen P soil test is not required. Equations to convert soil Bray P or Mehlich P to Olsen P are provided.

For high P soils (>100 ppm Bray, >100 ppm Mehlich, or >50 ppm Olsen) standard soil test P analysis will not provide an accurate measure of soil test P concentration. A "Nutrient Management Phosphorus Test" has been developed for high P soils and this test is recommended. The Nutrient Management Phosphorus Test (http://soiltest.coafes.umn.edu/methods.htm#NUTRIENTMANAGEMENTP) is a modification of the Olsen P procedure, with a sample dilution that allows more accuracy for high P soils. The Olsen method is recommended for this test because it can be used on all soils in the state, while the Bray and Mehlich methods cannot be accurately used on calcareous soils.

In most situations, the change in total P due to fertilization or crop removal is small for periods of 3 years or less and these changes are not critical for the purposes of the P Index. In some situations, such as very high P application rates, it may be useful to consider the effects of changes in soil test P since the last soil test on total soil P. Changes in soil test P are important for longer periods of time and should be estimated if the P Index will be used to project the effects of management several years ahead. In these situations, an optional procedure is included to adjust the Olsen P value to account for additions and/or removals of P.

The optional soil test P adjustment is estimated from a combination of P application rate (fertilizer or manure), a **Soil P Buffer Factor** that varies with soil texture and pH (calcareous soils), and an "average" crop removal factor (Randall et al., 1997) of 30-lb. P_2O_5/acre (equation 6). For CRP, pastures, woodland, and similar areas the crop removal factor is zero. The Soil P Buffer Factors are based on Minnesota research (Moncrief and. Evans, 1994) and other supporting data (Peck et al., 1971).

Hydrologic research has shown that concentrations of particulate contaminants such as P are higher for eroded soil particles than for the bulk soil. Enrichment ratios can be used to estimate the higher concentrations. However, we found that the P Index calculations were not very sensitive to this enrichment factors and therefore, we have not included them in the MN P Site Index calculations. Further research may show that including an enrichment ratio is warranted.

II. Soluble P, Rainfall

This pathway estimates the risk of soluble P losses in rainfall runoff. The risk is a function of the estimated runoff volume and the concentration of soluble P in rainfall runoff. The concentration of soluble P in rainfall runoff is the combination of soluble P originating from the soil (including P fertilizer and manure applied since the last soil test) and P solublized from unincorporated manure or fertilizer P applied during the current crop year (crop years are defined as the period between harvest of one crop and harvest of the succeeding crop).

The volume of runoff for a field is estimated based on hydrologic soil group, geographic location, vegetation, and the percent surface cover. Hydrologic soil groups are a function of soil texture and permeability and relate to the tendency of water to runoff from the given soil. Hydrologic soil groups are reported in County Soil Survey manuals as group A, B, C, or D. Runoff potential ranges from group A soils with low runoff potential to group D soils with high runoff potential. In Minnesota, many group C and D soils have been artificially drained. When drainage is present for these soils classified as group C or D, the soil hydrologic group should be changed to group B.

Runoff Volume. A base runoff volume map is provided that reflects differences in runoff due to geographic differences in historical rainfall patterns. The base runoff map was created using the SCS Curve number method and historical rainfall records. Estimates are based on hydrologic soil group B in row crop production.

For other soil and vegetation types, a table of **Runoff Adjustment Factors** is provided and is also determined with the Curve number model. After adjusting the baseline values, some fields will have more runoff than average, while others will have less.

Soluble P From Soil. The concentration of soluble P in runoff can be predicted based on soil test P. As for the Particulate P, Rainfall section, this step requires a soil test taken within the last three years. A linear relationships between Olsen P and runoff soluble P was developed for Minnesota soils (Appendix B). Results of Bray or Mehlich soil tests should first be converted to an equivalent Olsen test value. If the soil test value was adjusted for P additions or removal in the Particulate P Rainfall section, then the adjusted value should also be used here. Similarly, the Nutrient Management Phosphorus Test is recommended for high P soils. Currently, the Minnesota P Index gives the same increase in soluble P from injected P and incorporated P. Further modifications may be made to vary the risk of P losses from incorporation in response to the type of tillage used for incorporation and the time elapsed between application and incorporation.

Soluble P From Applied Fertilizer or Manure. This step accounts for direct losses of soluble P associated with fertilizer and manure applied during the spring, summer, or fall (before November 15 and after April 1). The algorithm used to calculate these P losses is based on application rate of P and P losses from published data sources (Edwards and Daniel, 1994; Edwards and Daniel, 1992; Mueller et al., 1983). This literature shows that approximately 3% of applied P can be potentially lost when high intensity rainfall occurs shortly following surface P application without incorporation. The **Applied P Factor** was computed as the effective P concentration in 1.35” of runoff that would generate a 3% loss of applied P. This calculation assumes that a runoff event does occur after manure application. When adjusted runoff is more or less than 1.35” annually, the risk of P loss from surface applied manure will vary accordingly. To account for incorporation of applied P, a factor is used that estimates the fraction of applied P that remains at the soil surface with different tillage tools. The incorporation efficiency figures were determined based on data illustrating the stratification of soil test P for various tillage systems and on the effect of tillage on surface residue (Randall et al., 1980; Randall et al., 1983). For example, the percent of applied P remaining at the soil surface is 0, 5, 50, and 100 for injection, moldboard plow, disk, and no till respectively.

To determine rate of P applied with manure, both the manure application rate and the concentration of P in manure are needed. It is recommended that a manure analysis be performed for each application period. If a manure analysis is not available, the P content can be estimated from the table provided in the User Guide.

III. Soluble P, Snowmelt

This pathway assesses the risk of P loss in snowmelt runoff. An estimate of the volume of runoff is made based on historical snow records and soil roughness. The mass of P loss is estimated as a constant percentage of P on the soil surface in crop residue or P applied during winter as manure or fertilizer.

Snowmelt Runoff Factor. A map is provided that shows the potential snowmelt runoff for different areas of the state. In Minnesota, most snowmelt runoff occurs during the spring thaw, usually in mid to late March. The base snowmelt runoff was determined by taking 65% of the average maximum snowpack for the period March 16 through March 31. The 65% figure is based on observations in small plot research done in Minnesota (Hansen et al., 2000; Munyankusi, 1999). The base snowmelt runoff volume represents the potential maximum runoff for a geographic area. However, site-specific conditions can result in wide differences in snowmelt runoff and associated P loss (Ginting et al., 1998; Hansen et al., 2000; Hansen et al., 2001; Munyankusi, 1999). The adjusted runoff volume reduces the base runoff using the **Fall Soil Condition** factor. The fall soil condition affects both the amount of snow retained and surface storage of water from melting snow. Crop residue traps snow, especially standing corn stalks in no till fields, and larger accumulations of snow increase the potential for snowmelt runoff. A rough soil surface, created by tillage, leaves depressions that can store water and reduce the volume of snowmelt runoff compared to the smoother surface of untilled fields. The combination of crop residue and surface roughness results in three to four times the volume of snowmelt runoff under no till compared to moldboard plowing. Tillage and planting direction also affect the volume of snowmelt runoff, with smaller amounts moving from fields that are farmed across the slope than up and down the slope.

Potential P Loss In Snowmelt. Phosphorus lost in snowmelt runoff can originate from crop residue or from winter applied fertilizer or manure. A table is provided to determine the amount of P in crop residue based on crop, crop yield, and tillage practice. Winter applied P is defined as any application occurring after Novermber 15 and before April 1. The quantity of P applied as fertilizer or manure during this time period is a required input. To determine rate of P applied with manure, both the manure application rate and the concentration of P in manure are required. It is recommended that a manure analysis be performed for each application period. If a manure analysis is not available, the P content can be estimated from the table provided in the User Guide.

The snowmelt risk calculation is based on the assumption that 18% of the applied P and the P in crop residue will be lost with 1" of runoff. Thus, risk increases with increasing winter P application rates and with increasing amounts of crop residue. In general, risk of P loss from crop residue is small relative to loss from winter applied P. When risk of snowmelt runoff is estimated to be more or less than 1", the risk of P loss will vary accordingly.

OVERALL RISK

The overall P site risk score is the sum of the risk values for each of the three pathways. A table is provided in the User Guide to help interpret the risk level. The calculated risks are classified as very low, low, medium, high, or very high. When risk is in the very low or low categories, no changes in management is recommended. In the medium risk category, small improvements in management may be necessary, and the producer should avoid management practices that increase the risk of P losses. In the high risk category, moderate improvements in management are recommended to lower the risk of P losses. In the very high risk category, multiple (and possibly large) improvements in management practices are recommended. Results from the P Index identify the causes of risk and suggest management practices that will be most effective in reducing risk. Maximum flexibility should be given to the producer to reduce risk in the most logical and economical way for them.

Testing and Evaluation

Water quality research from Minnesota was used to test and evaluate the Minnesota P Site Index. Four specific studies were used as the primary data for the testing and evaluation. The **Cedar Lake** study was a paired watershed study conducted in Scott County, Minnesota from 1995-2000 (Hansen et al., 2001). This study compared P losses in snowmelt and rainfall runoff as affected by tillage practice in a continuous corn rotation. The **Nytes** study was a paired watershed study, also conducted in Scott

County, Minnesota from 1996-2001 and compared P losses in snowmelt and rainfall runoff as affected by tillage practise in a corn-soybean rotation. The **Lancaster** study was replicated plot research conducted in Lancaster, Wisconsin from 1994 to 1995 (Munyankusi, 1999). The study evaluated P loss in runoff as affected by tillage practice and timing of manure application. Finally, the **Morris** study was conducted in Morris, Minnesota from 1994 To 1996 (Ginting et al., 1998). This was a replicated plot study that evaluated the effects of tillage and manure application on P losses.

From each of these studies, the annual loss of total P was compared against the risk calculated by the Minnesota P site index. For this comparison, measured values of runoff volume and soil loss were used, rather than estimated values.

The annual loss of total P from these sites was linearly related to the P Index risk score (r^2=0.68), but over-predicted losses by about 25%. Thus P Index risks are proportional to the loss of P from these sites. At most study sites, the Particulate P Rainfall Losses were dominant, and the risk from this pathway was well correlated with measured particulate P losses. Losses of soluble P by rainfall or snowmelt at these sites represented a small fraction of the total annual P loss, and the P Index was not as accurate in predicting these losses as sediment P losses. There are, however, management practices and site conditions not investigated at these sites that can lead to situations where P losses in rainfall runoff or snowmelt runoff exceed the losses of particulate P.

Sensitivity Analysis

Hypothetical scenarios using a wide range of inputs that represent the range of conditions in Minnesota were created to evaluated the sensitivity of the Minnesota P site index. A summary of results was constructed from a set of varying site conditions and management practices to represent a range of agricultural situations where the Index might be applied. Table 2 provides examples of P Index risk ratings for different site conditions and management options, illustrating results that can be expected by varying some of these conditions and management, and providing comments on the main parameters affecting the risk rating for each of the scenarios.

The scenarios evaluated included differences in:

1. Distance to surface water – 10, 100, 500, and 1000 ft
2. Soil test phosphorus (Olsen-P) – 10, 30, and 150 ppm
3. Phosphorus application rate, method, and timing – 0 to 200 lb P_2O_5/acre; surface and incorporated; manure and fertilizer; spring, fall, and winter
4. Erosion rate – 0.2 to 12 tons/acre
5. Tillage type and orientation – moldboard plow, chisel plow, ridge till, and no till; across slope and up-and-down slope
6. Crop(s) grown – corn, soybeans, corn/soybean rotation, pasture, CRP
7. Rainfall and late-spring snowpack amounts
8. Presence of a buffer/filter strip

For each of the scenarios, the site conditions and management practices selected were evaluated by running them through the Minnesota P Index. RUSLE or RUSLE2 was used to estimate erosion and the Tables and Figures described in the P Index documentation were used to determine other required input values.

Two site conditions, soil texture and soil hydrologic group, were not varied in any of the selected scenarios. A soil with silt loam texture in hydrologic group B (moderate infiltration rates, moderately well- to well-drained) was assumed in all cases. This was done to make it easier to compare management practices across a more uniform set of conditions. Differences in soil texture and hydrologic group will affect P transport through their effects on factors like soil erosion and surface runoff of water, but we wanted to focus on evaluating the parameters that can be changed through management.

Field Pilot Testing

Field pilot testing of the Minnesota P Index was performed to evaluate usability, the availability of required inputs, and the logic and usefulness of results. The production farm at the University of Minnesota, West Central Research and Outreach Center (WCROC) in Morris, MN was chosen as the location for the field pilot test.

Site Description. *The WCROC farm consists of approximately 1,300 acres of crop and pasture land. Crop production consists primarily of corn and soybeans in rotation, with smaller areas of small grain and alfalfa production. Manure from dairy and swine is land applied in the cropping system. Pastures are managed to maintain a mixed stand of grasses and legumes and are rotationally grazed by both cows and sheep. Soils at the WCROC are formed in calcareous loamy glacial till and are located in an area of native tall grass prairie. The Pomme de Terre River flows through a section of the farm and is a tributary to the Minnesota River. Landscape is typical of glacial till, with rolling hills and variable slopes. Many of the soils are prone to erosion.*

P Index Calculations. Risk calculations were performed on 35 individual fields, each found in one of 4 divisions of the WCROC farm. The four divisions are referred to as North Farm, Sommers Farm, East Farm, and East Pastures/Farm. Calculations were based on information from the 2001 crop year. For most fields, soil test P results were available within the last 3 years. Soil Olsen P values ranged from 5 to 69 ppm and averaged 20 ppm (Figure 2). Soils with Olsen P values greater than 20 ppm generally reflect a history of manure application. The fields on the North Farm have not had manure applied in the recent past.

Soil erosion calculations were done for each field as an input to the P Index. Soil erosion varied from 0.25 to 4.7 T/ac/yr and averaged 0.80 T/ac/yr (Figure 3). The North and East farms are managed in corn and soybeans, but erosion is low because the fields are flat. The Sommers Farm is also managed in corn and soybeans, but has moderate slopes. Fields from the East Pastures/Farm have the steepest slopes at the WCROC farm. Three fields are cropped to corn and soybeans and have the highest erosion risk for the WCROC farm. Fields from the East Pastures also have steep slopes, but erosion risk is low because of the permanent vegetation.

Runoff risk was determined for the farm using a base runoff of 1.3 in/yr. Soil hydrologic group was B for all soils at the WCROC. Runoff adjustment factors were 1.0 for row crops, 0.67 for small grains, and 0.30 for pastures. As a result, the highest runoff risk generally corresponded to the same fields as ranked highest for erosion risk.

The P Index risk assessment is shown in Figure 4. The P Index scores ranged from 0.2 to 11 and averaged 0.9. Eighty percent of the fields had P Index values less than 1.0. This illustrates that management practices on most fields at the WCROC posed little risk of P loss, while risk was high for a few fields. Improvements would be best accomplished by changing management practices on four individual fields having P Index scores greater than 4.0. For each of these sites, the risk was high due to surface application of manure without incorporation. Changing manure application methods would reduce the risk at each site to a value below 4.0.

Usability. A junior performed the pilot testing. An orientation and training session was required in order for this person to utilize the P Index. After orientation, the staff member was able to understand and execute the calculations effectively. On occasion, he required some additional clarification. Feedback was used to improve and clarify the documentation.

The P Index computations for all 35 fields was relatively time consuming, requiring approximately 10 hours of time. A large percentage of the time was spent obtaining necessary input data for the calculations. Another time-consuming element was managing the data in a spreadsheet. Since a large percentage of the fields were found to have little risk, it would be desirable to develop a simpler initial screening tool that would be used to determine if the entire P Index calculation was needed. Several other states have proposed use of some kind of screening tool.

The field pilot testing clearly identified the need to create a user-friendly interface for the P Index. A user friendly interface would hide much of the complexity to the user, simplify the data handling, and require much less time than the current text version of the P Index.

Availability of Required Inputs. The inputs for the P Index were obtained from a combination of the P Index User Guide and all the following resources:

- County Soil Survey (soil types, soil hydrologic group)
- USDA-NRCS field office (RUSLE prediction based on R, K, C, LS factors)
- Farm records (STP, P application rates, manure analysis, cropping system)
- Map and personal knowledge (distance from field edge to water body)

All of the inputs required were available for P Index calculations at the WCROC. However, it may be anticipated that many land managers will lack STP, manure analysis, and records of P application history.

Logic And Usefulness. The results of the P Index Pilot Test were reviewed with the WCROC farm management team. The reaction of the team was very positive. The only concern expressed surrounded the high P Index scores for fields on the East Farm. The farm management team agreed that risk scores there would be higher due to manure application without incorporation, but thought that the flat slope at these sites would lower the risk. After obtaining P Index results, WCROC farm management team reviewed their current manure management plans and identified alternative management practices that would reduce the P Index scores on all fields where it was high. The management solutions identified were incorporation of manure and a change in timing of manure application.

Field Pilot Test Summary. The field pilot test illustrated the utility of the Minnesota P Site Index for differentiating risk of off-site P movement based on landscape and land management factors. The necessary inputs for these sites were available from a combination of sources. It is anticipated that in practice, many land owners will lack soil and manure analysis data. The P Index requires some technical skills and training for the user in its current format and it is somewhat time consuming to use. However, a proposed user-interface will resolve these concerns to make the P Index more user friendly.

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Table 1. Comparison of factors used in several phosphorus indices.

MATRIX ELEMENT	-- INDEX DEVELOPER OR STATE ----------------------------------						
	Lemunyon & Gilbert	Gburek et al.	Sharpley	MD	VT	FL	WI	IA*
Source factors								
Soil Test Phosphorus	X	X	X	X	X	X	X	X
Fertilizer P application rate	X	X	X	X	X	X	X	X
Fertilizer P application method	X	X	X	X	X	X	X	X
Organic P application rate	X	X	X	X	X	X	X	X
Organic P application method	X	X	X	X	X	X	X	X
Transport factors								
Soil erosion	X	X	X	X	X	X	X	X
Irrigation erosion	X	-	-	-	-	-	-	-
Runoff	X	X	X	X	X	X	X	X
Leaching potential	-	-	X	X	-	X	-	-
Distance to water body	-	X	X	X	-	-	X	X
Buffer strip	-	-	-	-	X	-	X	X
Subsurface drainage	-	-	X	X	-	-	-	X
Hydrological return period	-	X	-	-	X	-	-	-
Sensitivity of receiving water	-	-	-	X	-	X	-	-
Index Mathematical Processing	additive	multiply	multiply	multiply	multiply	multiply	multiply	additive

Table 2. Summary of Minnesota P site index calculations for hypothetical scenarios used for the sensitivity analysis.

						Summary of Pathway Model Results			(9/11/02)							
P Break	P Index	P1	P2	P3	Erosion	Rate of P	Timing of P	Method of P	STP	Rainfall Runoff	Snow Pack	Buffer Strip	Distance	Tillage-Soybean	Tillage-Corn	Comments
	0.32	0.06	0.05	0.21	0.2	23.4	N/A	grazing	10	2.1	0.8	0	10			Grazed pasture low stocking rate
	0.75	0.53	0.03	0.19	2.23	0	N/A	N/A	10	1.5	0.75	0	1000	No-till across slope		Excellent management
	0.85	0.45	0.04	0.36	1.9	0	N/A	N/A	10	2.1	0.8	0	1000		Ridge on contour	Excellent management
	0.86	0.53	0.03	0.3	2.23	0	N/A	N/A	10	1.8	1	0	1000	No-till across slope		Excellent management
	0.88	0.06	0.004	0.81	0.2	0	N/A	N/A	10	2.1	0.8	0	10			CRP
	0.92	0.7	0.03	0.18	2.97	0	N/A	N/A	10	1.5	0.75	0	1000	Fall no-till	Chisel across slope	Excellent management
0-1	0.99	0.53	0.03	0.43	2.23	0	N/A	N/A	10	1.5	1.75	0	1000	No-till across slope		Excellent management
	1.03	0.7	0.03	0.29	2.97	0	N/A	N/A	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, no appl. P
	1.06	0.88	0.03	0.15	3.71	0	N/A	N/A	10	1.5	0.75	0	1000		Chisel across slope	Erosion near T, low STP, no P appl.
	1.10	0.70	0.03	0.36	2.97	0	N/A	N/A	10	1.5	0.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, no P appl.
	1.15	0.88	0.03	0.24	3.71	0	N/A	N/A	10	1.8	1	0	1000		Chisel across slope	Erosion near T, low STP, no P appl.
	1.15	0.7	0.03	0.42	2.97	0	N/A	N/A	10	1.5	1.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, no P appl.
	1.26	1.02	0.02	0.22	4.3	0	N/A	N/A	10	1.3	0.8	0	1000		Fall chisel up and down slope	Erosion near T, low STP, no appl. P
	1.26	0.88	0.03	0.35	3.71	0	N/A	N/A	10	1.5	1.75	0	1000		Chisel across slope	Erosion near T, low STP, no P appl.
	1.27	1.02	0.04	0.22	4.3	0	N/A	N/A	10	2.1	0.75	0	1000		Fall chisel up and down slope	Erosion near T, low STP, no appl. P
	1.28	0.68	0.57	0.03	3.71	200	fall	inject	10	1.8	1	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Inject
	1.3	0.87	0.03	0.4	3.66	0	N/A	N/A	10	1.8	1	0	1000	No-till up and down slope		Erosion near T, low STP, no appl. P
	1.32	0.7	0.03	0.58	2.97	0	N/A	N/A	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, no appl. P
	1.35	1.28	0.06	0.01	5.4	0	N/A	N/A	10	1.8	1	0	1000		Moldboard cross slope	Erosion near T, low STP, no appl. P
	1.35	1.28	0.06	0.01	5.4	0	N/A	N/A	10	1.5	0.75	0	1000		Moldboard cross slope	Erosion near T, low STP, no appl. P
	1.35	0.99	0.33	0.03	5.4	200	fall	incorporated	10	1.8	1	0	1000		Moldboard cross slope	Erosion near T, low STP, P incorp
	1.36	1.28	0.06	0.02	5.4	0	N/A	N/A	10	1.5	1.75	0	1000		Moldboard cross slope	Erosion near T, low STP, no appl. P
	1.48	1.02	0.04	0.43	4.3	0	N/A	N/A	10	2.1	1.75	0	1000		Fall chisel up and down slope	Erosion near T, low STP, no appl. P
	1.52	1.17	0.33	0.01	6.35	200	fall	incorporated	10	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Incorp
	1.57	1.5	0.06	0.01	6.35	0	N/A	N/A	10	1.5	0.75	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, no appl. P
	1.57	1.5	0.06	0.01	6.35	0	N/A	N/A	10	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, no appl. P
	1.57	0.7	0.03	0.83	2.97	0	N/A	N/A	10	1.5	1.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, no appl. P
	1.57	1.5	0.06	0.01	6.35	0	N/A	N/A	10	1.5	1.75	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, no appl. P
	1.67	1.23	0.03	0.4	5.21	0	N/A	N/A	10	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, low STP, no appl. P
	1.70	1.11	0.57	0.03	3.71	200	fall	inject	10	1.8	1	0	100		Chisel across slope	Erosion near T, high SDR, low STP, v. high P appl. Inject
	1.70	1.34	0.33	0.03	7.3	200	fall	incorporated	10	1.8	1	0	1000	Moldboard across slope		Mod. Erosion, low STP, v. high P appl.incorp
	1.76	0.68	1.05	0.03	3.71	200	fall	incorporated	10	1.8	1	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Incorp
	1.79	1.73	0.06	0.01	7.3	0	N/A	N/A	10	1.8	1	0	1000	Moldboard across slope		Mod. Erosion, low STP, no appl. P
	1.79	1.73	0.06	0.00	7.3	0	N/A	N/A	10	1.5	0.75	0	1000	Moldboard across slope		Mod. Erosion, low STP, no P appl.
	1.80	1.73	0.06	0.01	7.3	0	N/A	N/A	10	1.5	1.75	0	1000	Moldboard across slope		Mod. Erosion, low STP, no P appl.
	1.8	0.88	0.56	0.36	1.9	0	N/A	N/A	150	2.1	0.8	0	1000		Ridge on contour	Low erosion, high STP, no appl. P
	1.81	1.03	0.48	0.3	2.23	0	N/A	N/A	150	1.8	1	0	1000	No-till across slope		Low erosion, high STP, no appl. P
	1.81	1.54	0.05	0.22	8	0	N/A	N/A	10	2.1	0.8	33	100		Fall chisel up and down slope	Mod erosion, low STP, no appl. P
	1.84	1.44	0.03	0.36	6.08	0	N/A	N/A	10	1.8	1	0	1000		Chisel up and down slope	Erosion near T, low STP, no P appl.
1-2	1.97	1.61	0.33	0.03	5.4	200	fall	incorporated	10	1.8	1	0	100		Moldboard cross slope	Erosion near T, high SDR, low STP, v. high P appl incorp
	2.07	1.23	0.03	0.81	5.21	0	N/A	N/A	10	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, low STP, no P appl.
	2.14	1.89	0.02	0.22	8	0	N/A	N/A	10	2.1	0.8	0	1000		Fall chisel up and down slope	Mod. Erosion, low STP, no appl. P
	2.14	1.37	0.48	0.29	2.97	0	N/A	N/A	150	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, high STP, no appl. P
	2.15	1.47	0.66	0.02	8	200	fall	inject	10	2.1	0.8	0	1000		Fall chisel up and down slope	Mod. Erosion, low STP, P inject
	2.18	2.10	0.06	0.01	8.85	0	N/A	N/A	10	1.8	1	0	1000		Moldboard up and down slope	High erosion, low STP, no P appl
	2.19	1.11	1.05	0.03	3.71	200	fall	incorporated	10	1.8	1	0	100		Chisel across slope	Erosion near T, high SDR, low STP, v. high P appl. Incorp
	2.26	1.90	0.33	0.03	6.35	200	fall	incorporated	10	1.8	1	0	100	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf., high SDR
	2.28	1.55	0.58	0.15	5	50	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, P incorp
	2.28	1.55	0.58	0.15	5	50	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, mod P appl.
	2.43	1.37	0.48	0.58	2.97	0	N/A	N/A	150	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, high STP, no P appl
	2.44	1.71	0.48	0.24	3.71	0	N/A	N/A	150	1.8	1	0	1000		Chisel across slope	Erosion near T, high STP, no P appl.
	2.54	2.18	0.33	0.03	7.3	200	fall	incorporated	10	1.8	1	0	100	Moldboard across slope		Mod. Erosion, high SDR, low STP, v. high P appl.incorp
	2.54	2.47	0.06	0.01	10.41	0	N/A	N/A	10	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	High erosion, low STP, no P appl
	2.57	1.69	0.48	0.4	3.66	0	N/A	N/A	150	1.8	1	0	1000	No-till up and down slope		Erosion near T, high STP, no appl. P
	2.59	1.55	0.11	0.93	5	50	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, mod P appl surf winter
	2.62	1.57	0.90	0.15	5	100	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, mod P appl. Incorp
	2.68	1.99	0.47	0.22	4.3	0	N/A	N/A	150	1.3	0.8	0	1000		Fall chisel up and down slope	Erosion near T, high STP, no P appl
	2.71	1.47	1.22	0.02	8	200	fall	incorporated	10	2.1	0.8	0	1000		Fall chisel up and down slope	Mod. Erosion, low STP, P incorp
	2.90	2.84	0.06	0.01	11.97	0	N/A	N/A	10	1.8	1	0	1000	Moldboard across slope		High Erosion, low STP, no appl. P
	2.99	1.33	0.09	1.58	5.4	200	winter	surface	10	1.5	0.75	0	1000		Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	2.99	1.58	1.26	0.15	5	150	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, high P appl. Incorp
	3.07	2.39	0.66	0.02	8	200	fall	inject	10	2.1	0.8	0	100		Fall chisel up and down slope	Mod. erosion, high SDR, low STP, high P appl inject
	3.22	1.56	0.09	1.58	6.35	200	winter	surface	10	1.5	0.75	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	3.29	2.39	0.75	0.15	2	0	N/A	N/A	150	2.1	0.8	0	100		Fall chisel cross slope	Low erosion, high SDR, high STP, no appl. P
	3.29	2.41	0.48	0.4	5.21	0	N/A	N/A	150	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, high STP, no appl. P
	3.32	1.59	1.58	0.15	5	200	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, v. high P appl. Incorp
	3.35	3.08	0.05	0.22	8	0	N/A	N/A	10	2.1	0.8	0	100		Fall chisel up and down slope	Mod erosion, high SDR, low STP, no appl. P
	3.37	2.49	0.87	0.01	5.4	0	N/A	N/A	150	1.8	1	0	1000		Moldboard cross slope	Erosion near T, high STP, no P appl
	3.39	1.57	1.67	0.15	5	100	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, high P appl. Surf
	3.41	1.57	0.12	1.72	5	100	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, high P appl winter surf
	3.45	1.79	0.09	1.57	7.3	200	winter	surface	10	1.5	0.75	0	1000	Moldboard across slope		Mod. Erosion, low STP, v. high P appl. Surf winter
	3.49	1.99	0.56	0.94	5	50	winter	surface	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, mod. P appl winter surf
	3.56	0.55	2.71	0.3	2.23	200	fall	surface	10	1.8	1	0	1000	No-till across slope		Low erosion, low STP, v. high P appl. fall surf
	3.56	0.55	2.71	0.3	2.23	200	fall	surface	10	1.8	1	0	1000	No-till across slope		Low erosion, low STP, v. high P appl. Surf
	3.63	2.39	1.22	0.02	8	200	fall	incorporated	10	2.1	0.8	0	100		Fall chisel up and down slope	Mod. erosion, high SDR, low STP, high P appl incorp
	3.65	2.81	0.48	0.36	6.08	0	N/A	N/A	150	1.8	1	0	1000		Chisel up and down slope	Erosion near T, high STP, no P appl.
	3.69	2.41	0.48	0.81	5.21	0	N/A	N/A	150	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, high STP, no P appl
	3.73	0.73	2.71	0.29	2.97	200	fall	surface	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P appl. Surf
	3.81	2.93	0.87	0.01	6.35	0	N/A	N/A	150	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, high STP, no P appl
	3.83	3.10	0.58	0.15	10	50	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, mod P appl incorp
	3.86	0.91	2.71	0.24	3.71	200	fall	surface	10	1.8	1	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Surf
	3.9	0.89	2.71	0.3	2.23	200	fall	surface	10	1.8	1	0	100	No-till across slope		Low erosion, high SDR, low STP, v. high P appl. Surf
	3.93	1.32	0.09	2.52	5.4	200	winter	surface	10	1.8	1	0	1000		Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	3.97	3.00	0.75	0.22	8	0	N/A	N/A	150	2.1	0.8	33	1000		Fall chisel up and down slope	Mod erosion, low SDR, high STP, no P appl
	3.99	0.47	3.16	0.36	1.9	200	fall	surface	10	2.1	0.8	0	1000		Ridge on contour	Low erosion, low STP, v. high P appl surf
2-4	4.00	1.99	1.86	0.15	5	50	fall/spring	incorporated fertil	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, mod P. appl incorp
	4.02	0.73	2.71	0.58	2.97	200	fall	surface	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P app. Surf
	4.03	0.47	0.06	3.5	1.9	200	winter	surface	10	2.1	0.8	0	1000		Ridge on contour	Low erosion, low STP, v. high P appl surf winter
	4.14	3.10	0.89	0.15	10	50	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, mod P appl surf
	4.15	3.10	0.11	0.94	10	50	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, mod P appl surf winter
	4.15	2.66	1.34	0.15	5	50	fall/spring	surface fertilizer	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, mod P. appl surf
	4.16	1.56	0.09	2.52	6.35	200	winter	surface	10	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	4.18	3.13	0.90	0.15	10	100	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, high P appl. Incorp
	4.19	1.58	2.46	0.15	5	150	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, high P appl surf
	4.21	1.58	0.13	2.50	5	150	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, high P appl surf winter
	4.24	3.37	0.87	0.01	7.3	0	N/A	N/A	150	1.8	1	0	1000	Moldboard across slope		Mod. Erosion, high STP, no appl. P
	4.25	0.91	0.05	3.29	3.71	200	winter	surface	10	1.5	0.75	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Surf winter
	4.30	2.01	0.57	1.72	5	100	winter	surface	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, high P appl winter surf
	4.30	2.01	2.14	0.15	5	100	fall/spring	incorporated fertil	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, high P. appl incorp
	4.33	3.69	0.42	0.22	8	0	N/A	N/A	150	2.1	0.8	0	1000		Fall chisel up and down slope	Mod erosion, high STP, no P appl
	4.39	1.79	0.09	2.52	7.3	200	winter	surface	10	1.8	1	0	1000	Moldboard across slope		Mod. Erosion, low STP, v. high P appl.surf winter
	4.57	3.16	1.26	0.15	10	150	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, v. high P appl incorp
	4.59	2.02	2.42	0.15	5	150	fall/spring	incorporated fertil	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P. appl incorp
	4.8	1.28	2.71	0.81	5.21	200	fall	surface	10	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, low STP, v. high P appl. Surface
	4.84	1.28	3.16	0.4	5.21	200	fall	surface	10	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, low STP, v. high P appl surf
	4.89	2.03	2.71	0.15	5	200	fall/spring	incorporated fertil	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P. appl incorp
	4.92	3.19	1.58	0.15	10	200	fall/spring	incorporated fertil	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, v. high P appl surf
	4.95	3.13	1.67	0.15	10	100	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, high P appl surf
	4.95	2.67	2.12	0.15	5	100	fall/spring	surface fertilizer	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, high P. appl surf
	4.96	4.08	0.87	0.01	8.85	0	N/A	N/A	150	1.8	1	0	1000		Moldboard up and down slope	High erosion, high STP, no P appl
	4.97	3.13	0.12	1.72	10	100	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, high P appl surf winter
	4.98	1.59	3.24	0.15	5	200	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, v. high P appl. Surf
	5.01	1.59	0.13	3.29	5	200	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	Erosion near T, mod STP, v. high P appl surf winter
	5.01	2.17	0.09	2.75	12.7	200	winter	surface	10	1.8	1	0	1000		Moldboard up and down slope	High erosion, lowSTP, v. high P appl surf winter
	5.01	1.49	3.16	0.36	6.08	200	fall	surface	10	1.8	1	0	1000		Chisel up and down slope	Erosion near T, low STP, v. high P appl. Surf
	5.04	1.33	0.09	3.63	5.4	200	winter	surface	10	1.5	1.75	0	1000		Moldboard cross slope	Erosion near T, low STP, v. high P appl surf winter
	5.10	2.02	0.57	2.51	5	150	winter	surface	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P appl surf winter
	5.27	1.56	0.09	3.62	6.35	200	winter	surface	10	1.5	1.75	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	5.28	1.72	3.16	0.4	3.66	200	fall	surface	10	1.8	1	0	1000	No-till up and down slope		Erosion near T, low STP, v. high P appl. Surf
	5.47	0.73	0.05	4.69	2.97	200	winter	surface	10	1.5	0.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P. appl surf winter
	5.49	1.79	0.09	3.62	7.3	200	winter	surface	10	1.5	1.75	0	1000	Moldboard across slope		Mod. Erosion, low STP, v. high P appl. Surf winter
	5.65	0.73	0.05	4.87	2.97	200	winter	surface	10	1.5	0.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P appl. Surf winter
	5.68	4.80	0.87	0.01	10.41	0	N/A	N/A	150	1.8	1	0	1000	Moldboard up and down slope	Moldboard up and down slope	High erosion, high STP, no P appl
	5.74	4.77	0.75	0.22	4	0	N/A	N/A	150	2.1	0.8	0	100		Fall chisel up and down slope	Erosion near T, high SDR, high STP, no P appl
	5.74	2.69	2.91	0.15	5	150	fall/spring	surface fertilizer	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P. appl surf
	5.77	3.16	2.46	0.15	10	150	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, high P appl surf
	5.79	3.16	0.13	2.50	10	150	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, high P appl surf winter
4-6	5.90	2.03	0.58	3.29	5	200	winter	surface	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P appl winter surf
	6.03	1.05	0.04	4.94	4.3	200	winter	surface	10	2.1	0.75	0	1000		Fall chisel up and down slope	Erosion near T, low STP, v. high P appl surf winter
	6.04	2.17	0.09	3.78	8.85	200	winter	surface	10	1.8	1	0	1000		Moldboard up and down slope	Mod erosion, low STP, v. high P appl surf winter
	6.21	1.32	4.88	0.01	5.4	200	fall	surface	10	1.8	1	0	1000		Moldboard cross slope	Erosion near T, low STP, v. high P appl surf
	6.22	0.91	0.05	5.26	3.71	200	winter	surface	10	1.8	1	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Surf winter
	6.4	1.96	4.22	0.22	8	200	fall	surface	10	2.1	0.8	0	1000		Fall chisel up and down slope	Mod erosion, low STP, v. high P appl surf
	6.40	5.53	0.87	0.01	11.97	0	N/A	N/A	150	1.8	1	0	1000	Moldboard across slope		High Erosion, high STP, no appl. P
	6.42	2.55	0.09	3.78	10.41	200	winter	surface	10	1.8	1	0	1000	Moldboard up and down slope	Moldboard up and down slope	High erosion, low STP, v. high P appl surf
	6.45	1.56	4.88	0.01	6.35	200	fall	surface	10	1.8	1	0	1000	Moldboard across slope	Moldboard across slope	Erosion near T, low STP, v. high P appl. Surf
	6.54	2.70	3.69	0.15	5	200	fall/spring	surface fertilizer	150	2.1	0.8	0	500		Chisel across slope	Erosion near T, high STP, v. high P. appl surf
	6.58	3.19	3.24	0.15	10	200	fall/spring	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod. STP, v. high P appl surf
	6.61	3.19	0.13	3.29	10	200	winter	surface fertilizer	30	2.1	0.8	0	500		Chisel across slope	High erosion, mod STP, v. high P appl winter surf
	6.67	0.55	0.05	6.08	2.23	200	winter	surface	10	1.5	0.75	0	1000	No-till across slope		Low erosion, low STP, v. high P appl. Winter surf
	6.68	1.79	4.88	0.01	7.3	200	fall	surface	10	1.8	1	0	1000	Moldboard across slope		Mod. Erosion, low STP, v. high P appl.surf
	6.80	2.93	0.09	3.78	11.97	200	winter	surface	10	1.8	1	0	1000	Moldboard across slope		High Erosion, low STP, v. high P appl.surf winter
	6.97	6.00	0.75	0.22	8	0	N/A	N/A	150	2.1	0.8	0	1000		Fall chisel up and down slope	Mod erosion, high STP, no P appl
	6.98	1.96	0.08	4.94	8	200	winter	surface	10	2.1	0.8	0	1000		Fall chisel up and down slope	Mod erosion, low STP, v. high P appl surf winter
	7.06	2.17	4.88	0.02	8.85	200	winter	surface	10	1.8	1	0	1000		Moldboard up and down slope	Hihg erosion, low STP, v. high P appl. Surf winter
	7.44	2.55	4.88	0.01	10.41	200	fall	surface	10	1.8	1	0	1000	Moldboard up and down slope	Moldboard up and down slope	High erosion, low STP, v. high. P appl surf
	7.84	2.93	4.88	0.03	11.97	200	fall	surface	10	1.8	1	0	1000	Moldboard across slope		High Erosion, low STP, v. high P appl.surf
	8.13	7.16	0.75	0.22	6	0	N/A	N/A	150	2.1	0.8	0	100		Fall chisel up and down slope	Erosion near T, high SDR, high STP, no P appl
	8.29	0.73	0.05	7.51	2.97	200	winter	surface	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P appl. Surf winter
	8.53	0.91	0.05	7.57	3.71	200	winter	surface	10	1.5	1.75	0	1000		Chisel across slope	Erosion near T, low STP, v. high P appl. Surf winter
	8.56	0.73	0.03	7.8	2.97	200	winter	surface	10	1.8	1	0	1000	Fall no-till	Chisel across slope	Erosion near T, high STP, v. high P appl. Surf. Winter
	9.88	1.49	0.50	7.90	6.08	200	winter	surface	10	1.8	1	0	1000		Chisel up and down slope	Erosion near T, low STP, v. high P appl. Surf winter
	10.31	0.55	0.05	9.72	2.23	200	winter	surface	10	1.8	1	0	1000	No-till across slope		Low erosion, low STP, v. high P appl. Winter surf
	10.51	9.54	0.75	0.22	8	0	N/A	N/A	150	2.1	0.8	0	100		Fall chisel up and down slope	Mod erosion, high SDR, high STP, no P appl
	10.55	1.05	0.04	9.46	4.3	200	winter	surface	10	2.1	1.75	0	1000		Fall chisel up and down slope	Erosion near T, low STP, v. high P appl surf winter
	11.57	0.73	0.05	10.8	2.97	200	winter	surface	10	1.5	1.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P. appl surf winter
	11.99	0.73	0.05	11.21	2.97	200	winter	surface	10	1.5	1.75	0	1000	Fall no-till	Chisel across slope	Erosion near T, low STP, v. high P appl. Surf. Winter
	12.18	1.28	0.05	10.85	5.21	200	winter	surface	10	1.8	1	0	1000	Fall no-till	Fall chisel up and down slope	Erosion near T, low STP, v. high P appl surf winter
	12.22	1.28	0.5	10.45	5.21	200	winter	surface	10	1.8	1	0	1000	Fall no-till	Chisel up and down slope	Erosion near T, low STP, v. high P appl surf winter
	14.57	0.55	0.05	13.97	2.23	200	winter	surface	10	1.5	1.75	0	1000	No-till across slope		Low erosion, low STP, v. high P appl. Winter surf
>6	15.18	1.72	0.5	12.96	3.66	200	winter	surface	10	1.8	1	0	1000	No-till up and down slope		Erosion near T, low STP, v. high P appl. Surf winter

Figure 1. Counties represented in soil sampling. A total of 160 soils were sampled and the samples are distributed throughout the indicated counties.

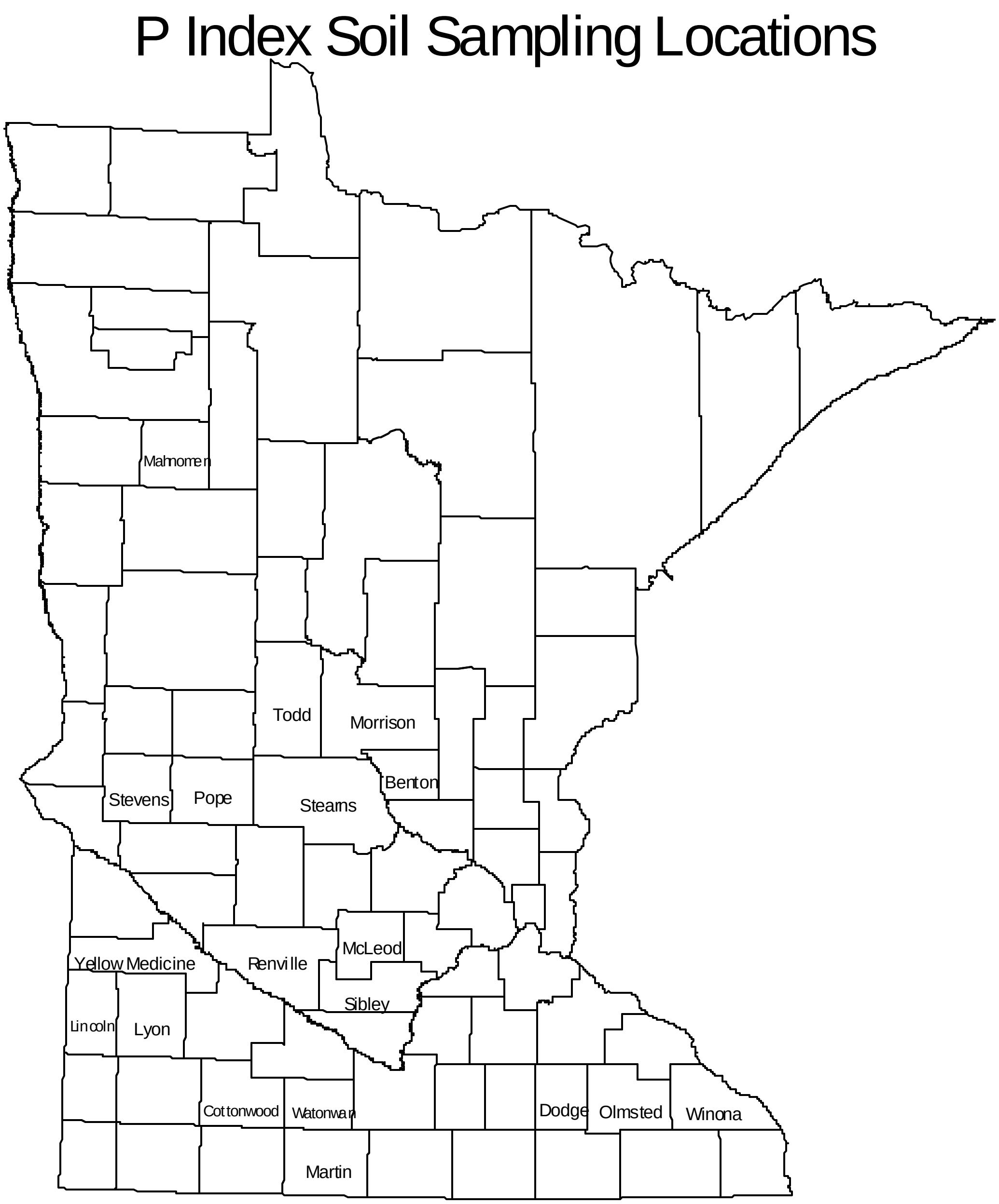


Figure 2. Soil Olsen P for 35 production fields at the University of Minnesota, West Central Research and Outreach Center, Morris, MN.

Figure 3. Soil Erosion, estimated with the Revised Universal Soil Loss Equation, for 35 production fields at the University of Minnesota, West Central Research and Outreach Center, Morris, MN.

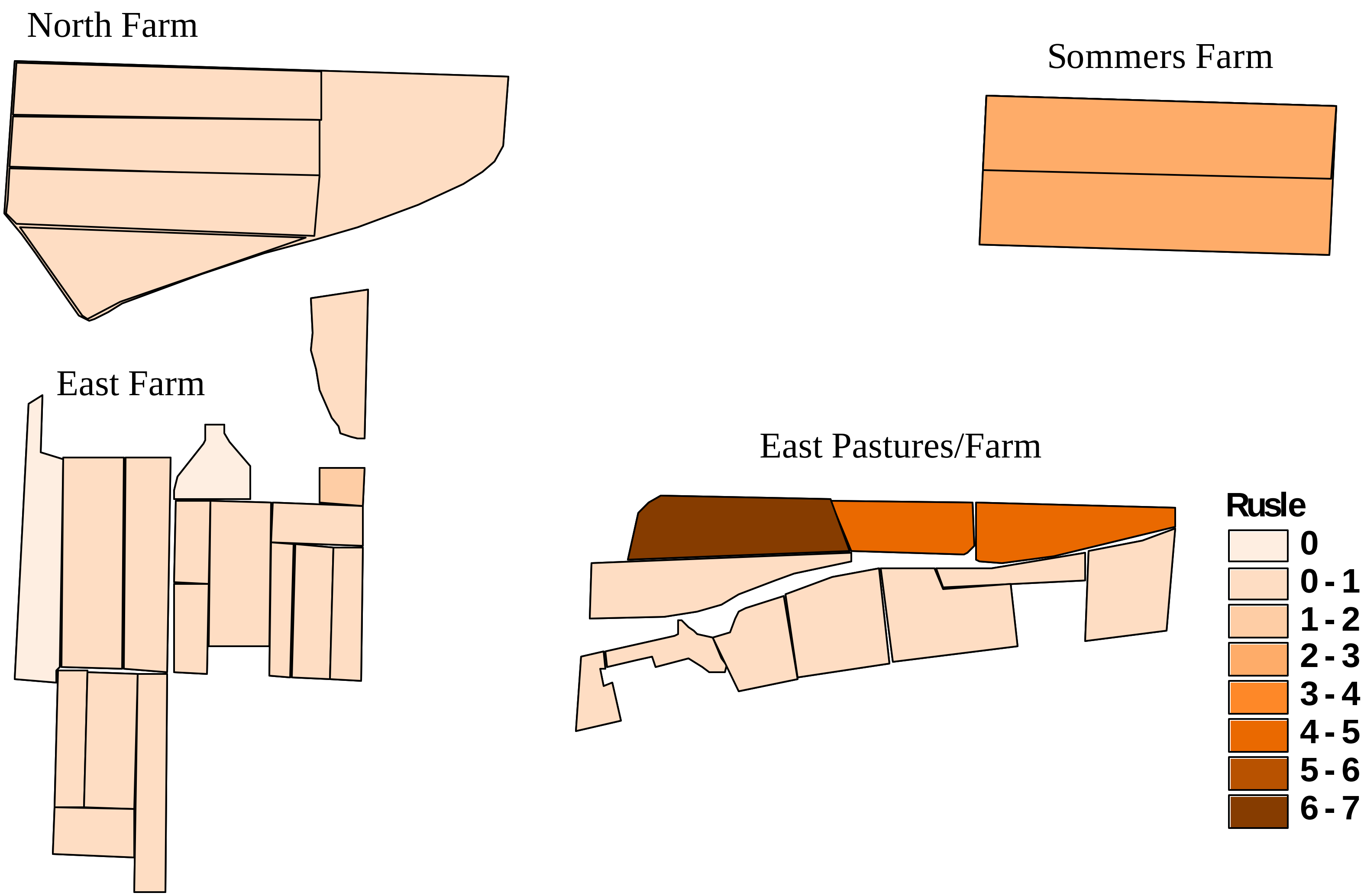
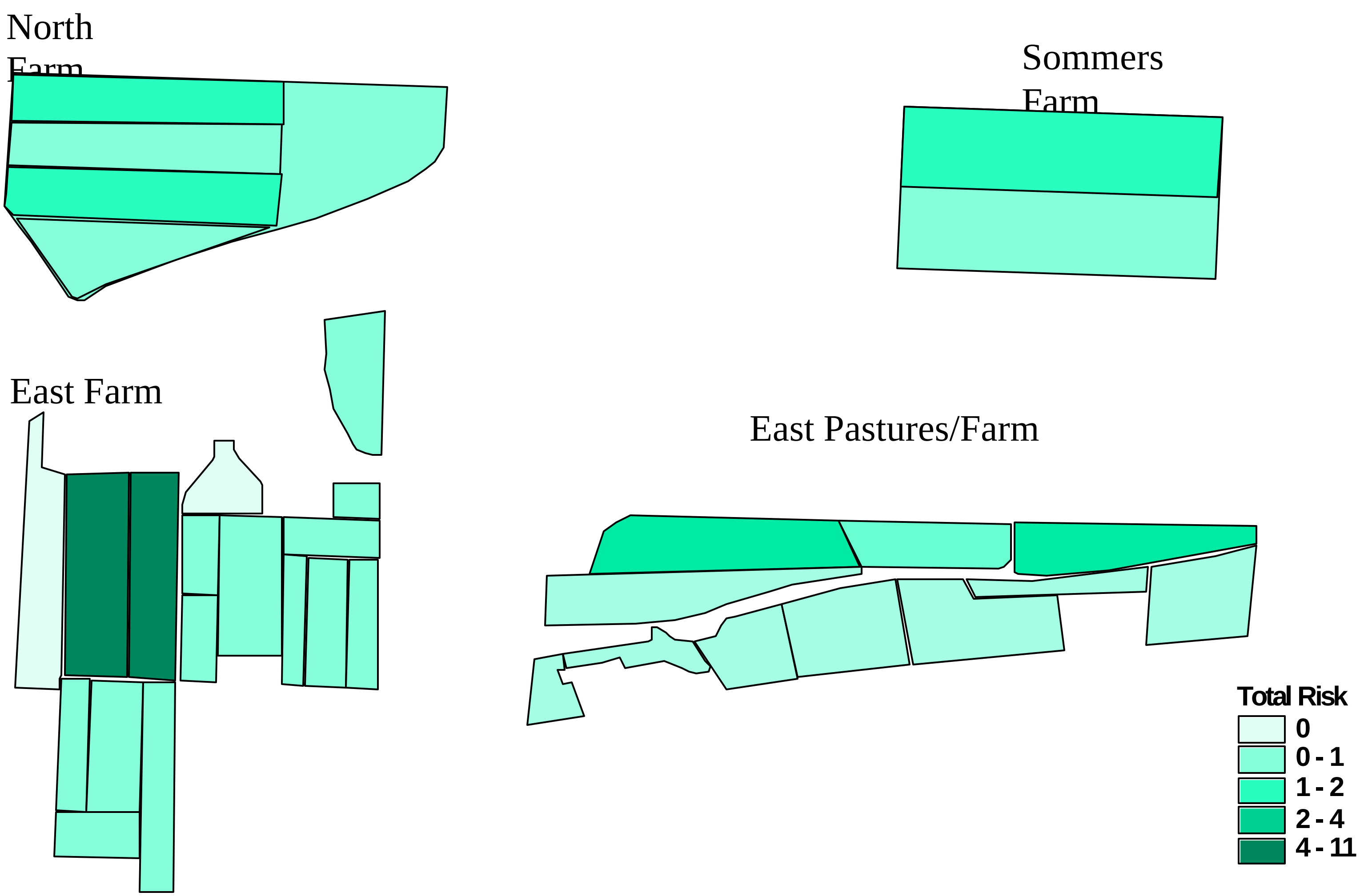


Figure 4. Phosphorus site risk index scores, for 35 production fields at the University of Minnesota, West Central Research and Outreach Center, Morris, MN.



Appendix A:
Details of Phosphorus Indices Evaluated in the Literature Review

Phosphorus Index Literature Review

The purpose of this review is to provide background on the development of the various phosphorus indices used or being developed in the US. From the review, we considered all of the factors used in the various indices for determining risk of phosphorus loss to surface water. Each factor was considered for relevance under Minnesota conditions. Additional factors unique to Minnesota are also considered, such as phosphorus movement by snowmelt runoff.

The original phosphorus index
The original phosphorus index was based on the concept that phosphorus loss from agricultural land is governed by the combination of "source factors" and "transport factors", (Lemunyon and Gilbert, 1993). The index was an eight-by-five weighted matrix that related the source and transport factors to the potential for phosphorus loss from a site (Table 1). Each factor is assigned a weighting factor based on its potential impact on the overall export of phosphorus from a field. The factors and their respective weight are:

Source Factors: agronomic soil test phosphorus (1.0), inorganic phosphorus application rate (0.75) and method (0.50), organic phosphorus application rate (1.0) and method (0.5).

Transport Factors: soil erosion (1.5), irrigation erosion, runoff class (0.5).

The values of the weighting factors were at the time based on the professional judgement of the group that developed the index. Each site characteristic had a range of numerical value ratings of low (1), Medium (2), High (4), or very high (8) (a base 2 system) (Sims et al., 2000). To calculate the phosphorus loss rating for each characteristic, the value of that characteristic was multiplied by its respective weighting factor. For example the weighted soil erosion value for a site with medium erosion was 2 * 1.5 = 3 (Table 1). The overall risk was then calculated by summing the weighted values. When the source and transport matrices are combined by adding their respective values, it is referred to as an *additive* index. The quantitative phosphorus loss score was then converted into a qualitative rating of site vulnerability to phosphorus loss as follows: Site phosphorus vulnerability rating: Low (<8), Medium (8-14), High (15-32), Very High > 32.

In the original phosphorus index, water erosion was calculated from the Revised Universal Soil Loss Equation (RUSLE) and wind erosion was calculated from the Wind Erosion Equation (WEQ). Runoff class was calculated from soil saturated hydraulic conductivity and the percentage slope of the site.

The authors of the original phosphorus index acknowledged the need for individual states to modify the index and its algorithm for specific uses or locations. The additive nature of the original index makes the value of such a rating questionable. It is possible to have a field with a high source value and low transport potential rated as a medium to high risk for phosphorus loss. Also, the original phosphorus index does not consider proximity of the field to receiving waters.

For this reason, it evaluates risk of phosphorus delivery to the field edge and not necessarily the risk of actual delivery to a water body.

A multiplicative phosphorus index
Gburek et al. (2000) evaluated hydrologic and chemical factors controlling phosphorus export from a 39.5 acre mixed watershed in Pennsylvania (using GIS modeling) and modified the original phosphorus index. The index assembled by Gburek et al. makes several adjustments to the original phosphorus index. The two most significant modifications made are:

1. The phosphorus source and transport matrices are combined in a *multiplicative* manner rather than using the additive approach.

2. Risk of phosphorus delivery from field edge to a water body is included by means of the hydrologic return period.

The inclusion of these two factors improved the utility of the index and provided a better fit with the water quality monitoring data from the watershed. The multiplicative approach provides a better way to identify sites at risk for off site movement of phosphorus due to the combination of source and transport properties. Further, when considering the impact of phosphorus on water quality, including a means to evaluate the connectivity of the field to surface water is important.

Multiplicative phosphorus index for northeastern US
Sharpley (2000) introduced a modified multiplicative phosphorus index for the Northeastern US. This index maintained the separation of source and transport factors with a multiplicative approach. Two additional tables were added to simplify the interpretation of the index score. The rating interpretation table relates the index score to the risk level (low, medium, high, very high) and the management options table assigns specific management choices depending upon the risk level. For example, if the risk is low, then nutrients can be managed on a nitrogen basis, while if the risk is high, phosphorus application is recommended at or below crop removal rates. Other important features of this index are the inclusion of factors for leaching potential, subsurface drainage, and distance from the edge of the field to surface waters.

Maryland phosphorus index
Scientists at the University of Maryland have modified the above multiplicative phosphorus index for the state of Maryland (Maryland Cooperative Extension, 2000). The Maryland phosphorus index is currently one of the most developed phosphorus indices in the US and its use is required for sites meeting certain criteria. The basic structure of that index is similar to the one presented by Sharpley. However, the addition of vulnerability ranking for the water body that receives the drainage water from the site makes it a more comprehensive index. The transport factor matrix has provisions for ranking the site with respect to distance from surface water and presence of vegetative buffers. The index has eight supplemental tables for calculating phosphorus loss ratings for various factors.

Vermont phosphorus index
The Vermont phosphorus index is a modification of the original phosphorus index (Lemunyon and Gilbert, 1993). Several unique features important in Vermont have been incorporated

(Jokela,1999). In the Vermont index, rather than using a categorical approach to calculating the index, a formula is used for both source and transport factors. The results of the two formulas are then combined in a multiplicative approach and the numerical outcome is translated into a qualitative phosphorus loss rating.

Another unique feature of the Vermont index is the inclusion of a soil analysis result other than soil test phosphorus. Specifically, Vermont researchers included a factor related to the amount of extractable aluminum in their phosphorus index. This is because the amount of extractable aluminum in the soil plays a significant role in phosphorus availability. In general, soils with higher aluminum have a higher capacity for phosphorus than those with lower aluminum (Jokela, 1999).

Florida phosphorus index

The Florida phosphorus index is another good example of adapting and modifying the original phosphorus index to address the needs of a specific region. A number of additional site and transport factors are included in the Florida phosphorus index. Similar to other indices, the Florida index divides the index into a source and a transport matrix and combines them with a multiplicative process. The quantitative score is then converted to a qualitative ranking from low to very high. Unique features of the Florida index are the inclusion of wastewater application as a separate factor and also the inclusion of a sensitivity factor for surface water bodies.

Wisconsin phosphorus index

Similar to other states, the Wisconsin index is composed of two matrices, one for *transport factors* and one for *site management factors* or phosphorus *source* (Bundy and Kaap, 1999). Weighting factors are used within each of the two matrices and the matrices are combined in a multiplicative manner. The Wisconsin index uses somewhat different weights for individual transport factors than those for other indices. The soil erosion factor is more heavily weighted. Also, a separate factor is included for the slope of the site and for distance to water. In the source factor matrix, more attention is focused on the nutrient management options than is apparent in other indices. This is based on the assumption that phosphorus loss potential is lower when manure is incorporated within one week after application compared to when it is left on the field over the winter. The value of the Wisconsin method-timing factor varies from 0.4 to 1.0, where 0.4 is used when phosphorus is incorporated 2" deep or more and 1.0 is used when phosphorus is incorporated greater than one week after application or is not incorporated for winter-applied manure. Also in the source matrix, the measured soil phosphorus level at the site is divided by 30 to obtain a comparison of the soil test value with an agronomically optimum value of 30 mg/kg for Bray phosphorus (Bundy and Kaap, 1999).

Iowa phosphorus index

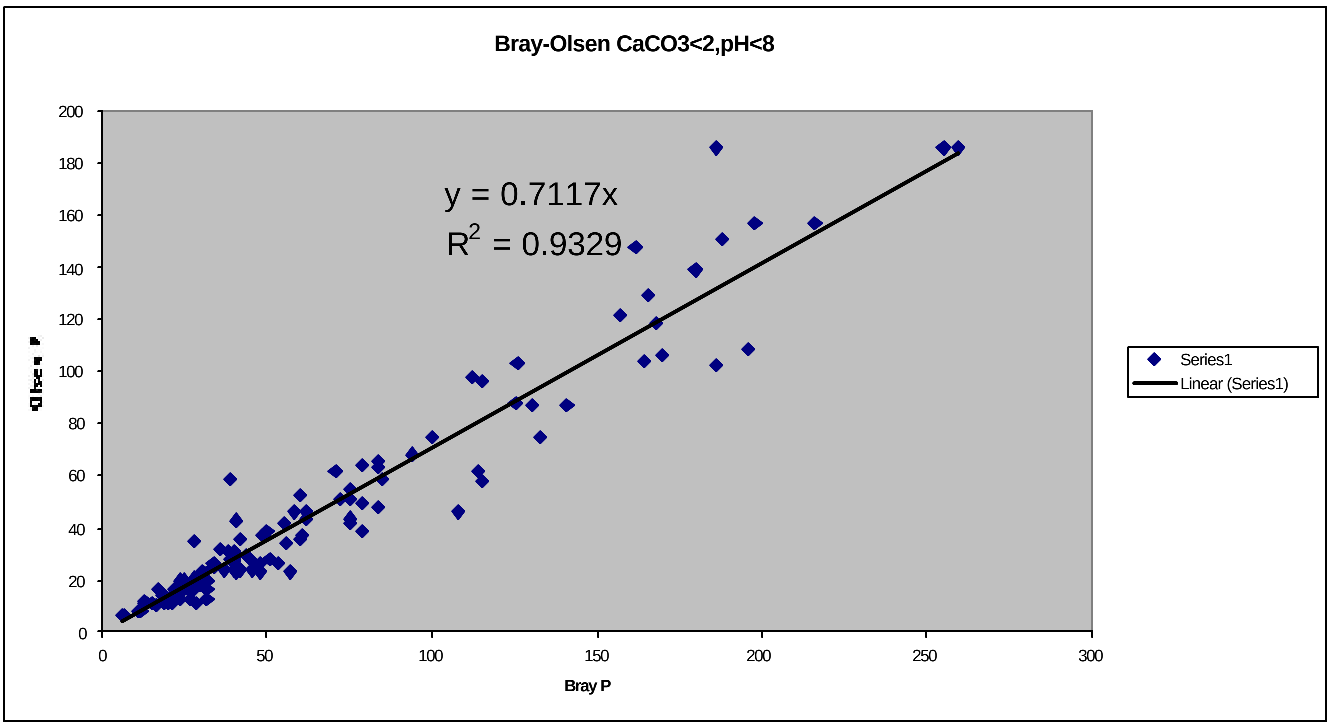
The Iowa phosphorus index is fundamentally different in approach than the original phosphorus index. This index does away with the categorical approach found in the other indices with the intent of developing a phosphorus index that generates a rough quantitative estimate of the phosphorus loss from a site. The developers argue that "lack of consideration of estimates of phosphorus loads that leave the field complicates the comparison (or normalization) of the different indices developed in various states" (Iowa NRCS, 2001).

The Iowa index is field based. While it acknowledges the importance of the interaction of the source and transport factors, it attempts to deal with these interactions internally within three components of the index: the *erosion* component, the *runoff* component, and the *subsurface drainage* component. Each of these components estimates the phosphorus lost from the field by that transport mechanism. When the three components are added together, the index is an estimate of the phosphorus lost from the field in lbs P/acre. The Iowa phosphorus index is unique in other ways as well. It puts more emphasis on bioavailable phosphorus than the other indices by including an availability factor for sediment P. It attempts to account for distance to receiving waters by using a sediment delivery ratio based on the distance from the edge of the field to the water. These additional considerations of the Iowa index lead to a complex, heavily developed phosphorus index that operates on several assumptions. The technical documentation for the index includes all the details necessary to calculate the index value in eight tables and four figures.

Appendix B:
Critical Data From The Soil Characterization

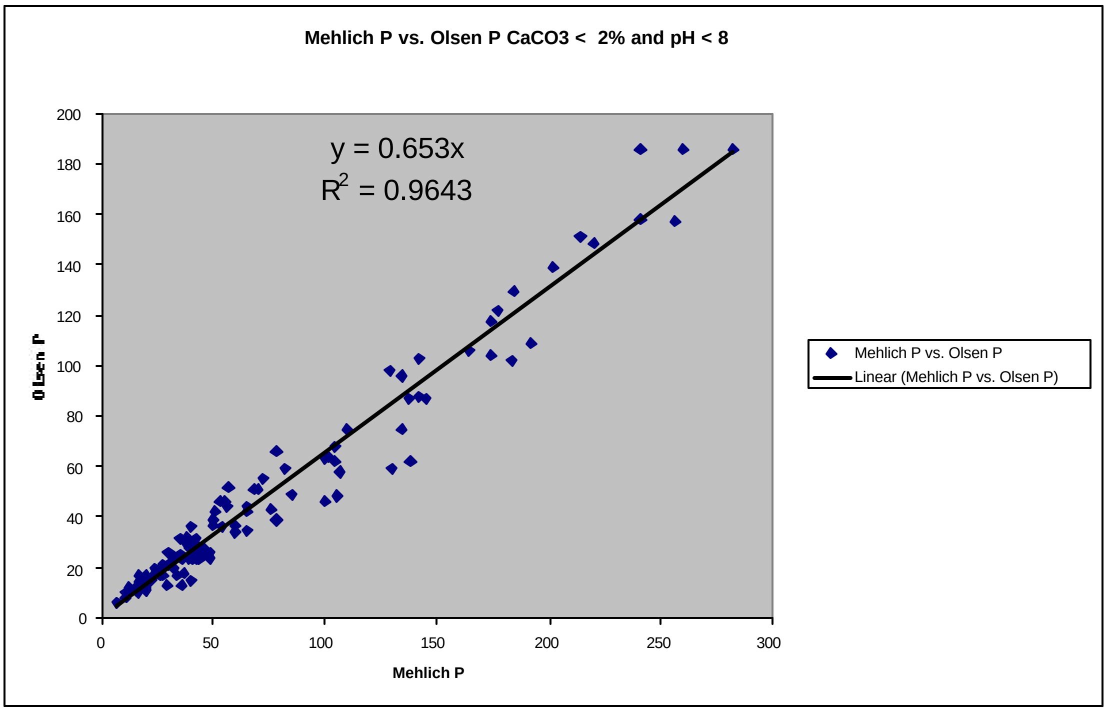
Bray vs. Olsen P for 119 Minnesota soils low in $CaCO_3$ and pH < 8.

Intercept forced through 0,0
Calculated intercept = -1.4
High carbonate and very high pH non carbonate soils give low Bray P
N = 119



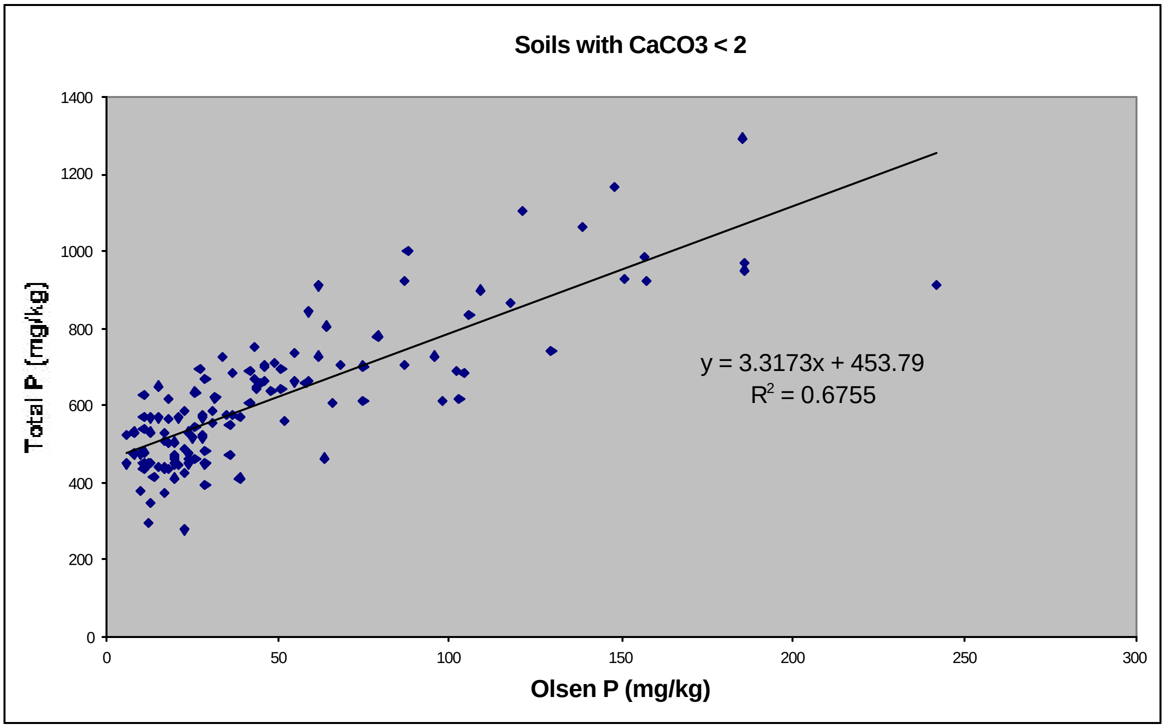
Mehlich vs. Olsen P for 119 Minnesota soils low $CaCO_3$ and pH < 8.

Intercept forced through 0,0
Calculated intercept = 0.47
Mehlich tolerates more buffering than Bray but for consistency the same population of s oils was used for this regression as for Bray vs. Olsen.
N = 119



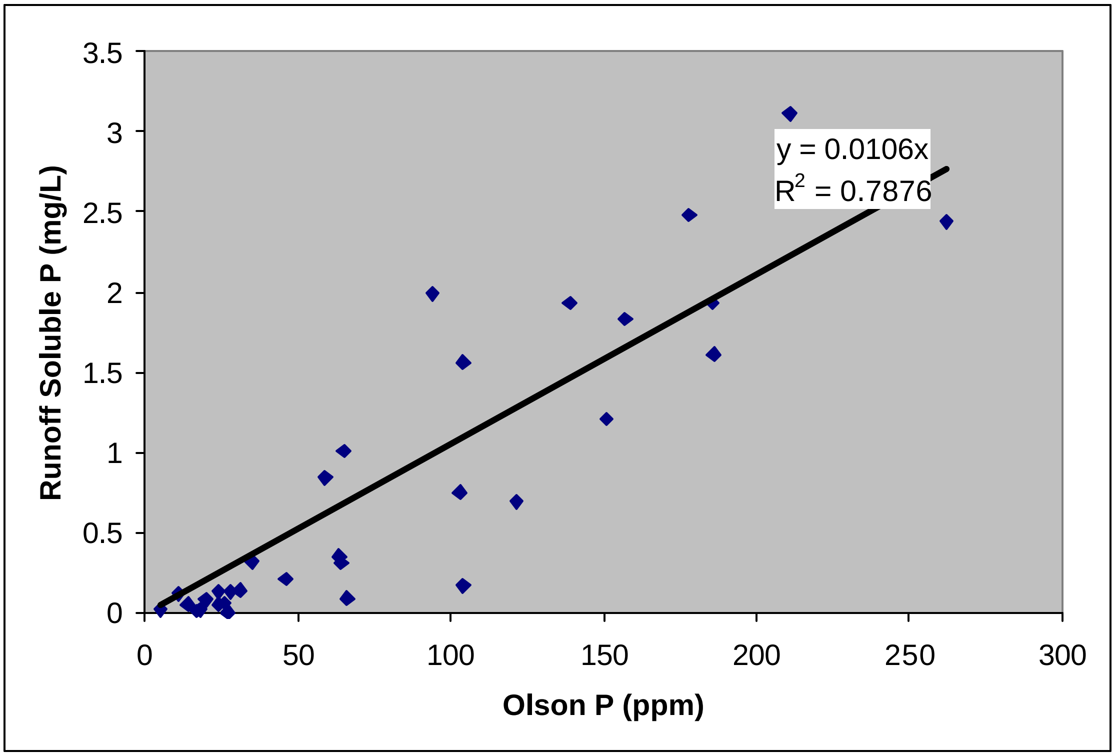
Total P vs. Olsen P for soils with $CaCO_3$. < 2%.

Some soils with high CaCO3 have a lot of occluded P and can have rather high total P with low Olsen P. The bioavailablity of this occluded P should be very low and thus it is appropriate to remove these points from the regression



Olsen P vs. Runoff Soluble P concentration.

This regression was made for soils used in the laboratory rainfall simulation. The regression allows prediction of the concentration of soluble P in runoff that originates from soil P, not from recently applied P.



Department of Soil,
Water, and Climate

Minnesota Phosphorus Site Risk Index

Users Guide

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The Minnesota P Index

This document is the Users Guide for calculating risk of phosphorus (P) movement from land to water using the Minnesota P site index. The Users Guide contains the necessary support tables and figures, and instructions to calculate and interpret the risk. Details about the development process and justification for each element in the Index are available in a companion document *"The Minnesota Phosphorus Site Index, Technical Guide"*.

The Minnesota P site index is developed based on the concept of independent pathways of P delivery from a field to water. The index combines input factors within each pathway to compute a risk score. The three pathways considered are 1) sediment-bound P from rainfall runoff, 2) soluble P from rainfall runoff, and 3) soluble P from snowmelt runoff. Wind erosion is not accounted for.

The Minnesota P site index calculation is completed using the *Calculation Worksheet*, and a series of support tables and figures. A brief overview of each factor is provided here and explained in more detail in *"The Minnesota Phosphorus Site Index, Technical Guide"*.

I. Sediment-bound P, Rainfall

Calculations in this pathway estimate the risks of P losses from a field to water by erosion transport processes. Each steps in this pathway is described here.

Sheet and rill erosion. The long-term average annual soil loss is estimated using the Revised Universal Soil Loss Equation, RUSLE (USDA-NRCS, 1996a) or RUSLE2 (USDA-NRCS, 2002). Soil type and topography vary across most fields, but often a critical part of the field can be identified that is most subject to soil loss. RUSLE calculations should be based on this "critical area". Assistance in obtaining an erosion estimate can be obtained from local office of the USDA-NRCS.

Manure factor. The manure factor is used to reduce the soil erosion estimate if manure was injected or incorporated within the last three years. Use a manure factor of one if manure is surface applied, and not incorporated.

Sediment Delivery. **In this step, the soil erosion estimate is reduced to account for deposition of sediments that occurs before reaching the nearest surface water body (perennial and intermittent streams, lakes and protected wetlands, and drainage ditches) or surface tile inlet. If erosion control structures exist, then a** Sediment Trap Factor **is used to represent deposition. When no sediment retaining features are present, then sediment deposition is calculated using a** Sediment Delivery Ratio (SDR)**, which is estimated based on the distance from field edge to surface water. Only one of these two factors is used in the calculation.**

Sediment Total P Concentration. The concentration of total P associated with delivered sediment is estimated from soil test P concentration determined within the past 3 years. A worksheet (Table 1) is provided to obtain soil total P based on native soil P levels and the results of an Olsen, Bray, or Mehlich P soil test. For high P soils (>100 ppm Bray, >100 ppm Mehlich, or >50 ppm Olsen) a "Nutrient Management Phosphorus Test" is recommended.

An optional calculation is provided in Table 1 to estimate changes in soil P concentration based on crop removal or P additions since the last soil test. This optional calculation is only needed for very high P application rates or when the P index is used for long range planning (> 5 yrs).

II. Soluble P, Rainfall

This pathway estimates the risks of soluble P losses in rainfall runoff. The risk is a function of the estimated runoff volume and the concentration of soluble P in rainfall runoff. The concentration of soluble P in rainfall runoff is the combination of soluble P originating from the soil (including injected or incorporated P fertilizer and manure applied since the last soil test) and P losses from unincorporated manure or surface fertilizer P applied during the current crop year (crop years are defined as the period between harvest of one crop and harvest of the succeeding crop).

Runoff Volume. A base runoff volume map is provided that reflects differences in runoff due to geographic differences in historical rainfall patterns. The base runoff is then modified for site specific conditions using the **Runoff Adjustment Factor**.

Soluble P From Soil. The concentration of soluble P in runoff is calculated from the soil test P using Table 3. As in the previous steps, the soil test should be taken within the last three years. If the optional adjustment in soil test was calculated in the Particulate P Rainfall section, then the adjusted value should also be used here. Similarly, the Nutrient Management Phosphorus Test is recommended for high P soils (>100 ppm Bray, >100 ppm Mehlich, or >50 ppm Olsen).

Soluble P From Applied Fertilizer or Manure. This step accounts for direct losses of soluble P associated with fertilizer and manure applied during the spring, summer, or fall (before November 15 and after April 1). The highest risk of a direct loss of applied P occurs when P is surface applied without incorporation. The risk decreases as a function of the incorporation efficiency of the tillage tool used. The calculation gives a zero risk of direct P loss for injected P applications. A worksheet (Table 5) is provided to determine rate of P applied with manure based on the manure application rate and the concentration of P in manure. It is recommended that a manure analysis be performed for each application period, but if a manure analysis is not available, the P content can be estimated from table 8.

III. Soluble P, Snowmelt

This pathway assesses the risk of P loss in snowmelt runoff. An estimate of the volume of runoff is made based on historical snow records and soil roughness. The mass of P loss is estimated as a percentage of P on the soil surface in crop residue or P applied during winter as manure or fertilizer.

Snowmelt Runoff Factor. A map is provided that shows the potential snowmelt runoff for different areas of the state. The base snowmelt runoff volume represents the potential maximum runoff for a geographic area. However, site-specific conditions are used to modify the actual snowmelt runoff volume. The base runoff volume is adjusted with the **Fall Soil Condition** factor (Table 6).

Potential P Loss In Snowmelt. Phosphorus lost in snowmelt runoff can originate from crop residue or from winter applied fertilizer or manure. The amount of P in crop residue is based on crop, crop yield, and tillage practice (Table 7). Winter applied P is defined as any application occurring after Novermber 15 and before April 1. A worksheet is provided to calculate the quantity of P applied as fertilizer or manure during this time period (Table 5). To determine rate of P applied with manure, both the manure application rate and the concentration of P in manure are required. It is recommended that a manure analysis be performed for each application period. If a manure analysis is not available, the P content can be estimated from Table 8.

OVERALL RISK

The overall P site risk score is the sum of the risk values for each of the three pathways. The calculated risk is classified as very low, low, medium, high, or very high. When risk is in the very low or low categories, no changes in management are recommended. In the medium risk category, small improvements in management may be necessary to lower the risk of P losses, and the producer should avoid management practices that increase the risk of P losses. In the high risk category, moderate improvements in management are recommended to reduce the P Index. In the very high risk category, multiple and possibly large improvements in management practices are recommended. Results from the P Index help identify the causes of high risk and suggest management practices that will be most effective at reducing risk.

Minnesota Phosphorus Site Risk Index
Calculation Worksheet

Use this worksheet and the accompanying tables and figures to calculate the Minnesota Phosphorus Site Risk Index Score. In each section of the worksheet, the first row of cells names the factor, the second row provides instructions on where to obtain the value, and the third row provides space to enter the value and perform the calculations.

Pathway I. Sediment Bound P, Rainfall

Erosion Rate		Manure Factor		Sediment Trap Factor *or* Sediment Delivery Ratio		Soil Total P Concentration		PATHWAY I RISK
Revised Universal Soil Loss Equation		Table 1		Table 2 *or* Figure 1 Enter lower of 2 values		Table 3, line 10		Multiply all factors and enter value here
	X		X		X		=	

Pathway II. Soluble P, Rainfall

Base Runoff Volume		Runoff Adjustment Factor		Soluble Soil P + Applied P		Coefficient		PATHWAY II RISK
Figure 2		Table 4		Table 3 line 11 + Table 5 line 8 Add the 2 values		Constant		Multiply all factors and enter value here
	X		X		X	**0.22**	=	

Pathway III. Soluble P, Snowmelt

Snowmelt Runoff Factor		Fall Soil Condition Factor		Residue P + Surface Applied P		Coefficient		PATHWAY III RISK
Figure 3		Table 6		Table 7 + Table 5 Line 12 Add the 2 values		Constant		Multiply all factors and enter value here
	X		X		X	**0.18**	=	

TOTAL RISK
Sum Risk From Each Pathway

Tables

Table 1. Manure Factor[a, b].

Manure Application Method	**Manure Factor** [c]
Broadcast and incorporated or injected	0.75
No manure applied or unincorporated manure	1.0

[a]For manure applied within the last 3 years.

[b]Manure application is not permitted within 25 ft. of surface water (perennial and intermittent streams, lakes and protected wetlands, and drainage ditches without berms); manure applied within 300 ft. of surface water or a surface tile inlet must be injected or incorporated within 24 hr. and before rainfall (see *Applying Manure in Sensitive Areas*, MPCA and NRCS).

[c]Gilley and Risse, 2000.

Table 2. Sediment Trap Factor.

Conservation Practice	**Trapping Factor**[a]
Level Terrace	0
Impoundments with Runoff Storage (Ponds, Grade Stabilization Structure with permanent pool)	0.05
Tile Inlet Terrace	0.05
Water & Sediment Control Basin	0.2
Standard Surface Tile Inlet	0.2
Standard Surface Tile Inlet with Buffer (Buffer >33 feet in width and >2 feet above riser pipe)	0.1
Gravel Inlet Structure	0.1
Buffer/Filter Strip (width site dependent, but no less than 33 feet wide)	0.5

[a] Trapping Factors for Standard Surface Tile Inlets and Gravel Inlet Structures based on MN research data (Ginting et al., 2000; Gieseke, 2000). Trapping Factor for Buffers based on USDA-NRCS, 1996b; Robinson et al., 1996; Munoz-Carpena et al., 1993; Dillaha et al., 1989; and Tollner et al., 1976. Remainder from the Iowa P Index (Table 1,Technical Note No. 25, Iowa NRCS).

Table 3. Soil Phosphorus Worksheet

Directions: Soil test phosphorus values are an important input for the P Index calculation. You are encouraged to use a soil analysis within the past 3 years. There are various methods of measuring and reporting soil test phosphorus. This worksheet will help you convert your soil test results to the format required in the P Index calculations. Read your soil test report carefully as you do each of the following steps. Be equally as careful when entering applied P values.

1. Enter the soil test phosphorus concentration from the test report	**1.**	
2. If the soil test report gives phosphorus in parts per million (ppm), then copy the value from box 1 to box 2. If the units are lbs P_2O_5/ac, then divide box 1 by 4.5 and enter in box 2.	**2.**	
3. Convert to Olsen Test P Olsen P=0.71 x Bray P-1 Olsen P=0.65 x Mehlich P **If the value was already an Olsen test, then re-enter value from line 2.**	**3.**	

Optional

Lines 4-8 are optional calculations that will estimate the change in soil test P since last soil test to the present or a future time due to incorporation or injection of P. Use this option for long range planning purposes. **4. Enter the number of years since the last soil test to the end of the projection.**	**4.**	
5. For harvested crops, multiply line 4 by 30 and enter the value	**5.**	
6. Enter the total lbs P_2O_5 applied and injected or incorporated as fertilizer and manure since the last soil test until the end of the projection.	**6.**	
7. Subtract line 5 from line 6. Values may be positive or negative.	**7.**	

8. For sandy loam or coarser textured soils, multiply line 7 by 0.05, for loam or finer texture soil, multiply line 7 by 0.03,

for calcareous soils (pH> 7.4), multiply line 7 by 0.02.

8.

9. Adjusted Olsen soil test P = line 3 + line 8

If you did not do optional calculation, then enter value from line 3. **9.**

10. Calculate soil Total P concentration

Total P Concentration (lb P/ton) = 0.0067 x line 9 + 0.92 **10.**

11. Calculate Soluble Soil P concentration **11.**

Concentration of Soluble Soil P = 0.0106 x line 9

Table 4. Rainfall Runoff Adjustment Factors for Different Soil Drainage Classes and Amount and Types of Vegetative Cover[a].

Soil hydrologic group[b]	A			B			C			D		
Surface cover[c] (%)	**<5**	**5-20**	**>20**	**<5**	**5-20**	**>20**	**<5**	**5-20**	**>20**	**<5**	**5-20**	**>20**
Vegetation type	--- **Adjustment Factor** --											
Row crops	0.56	0.42	0.25	1.35	1.00	0.75	2.63	1.96	1.48	3.58	2.65	1.98
Small grains	0.27	0.22	0.15	0.84	0.67	0.55	1.82	1.48	1.23	2.63	2.17	1.82
Alfalfa and other forages	----	----	0.12	----	----	0.55	----	----	1.37	----	----	1.98
Pasture[d]	----	----	0.02	----	----	0.30	----	----	1.08	----	----	1.82
CRP and other ungrazed, permanent vegetation[e]	----	----	0.01	----	----	0.12	----	----	0.50	----	----	1.00
Woodland[f]	----	----	0.01	----	----	0.15	----	----	0.62	----	----	1.10

[a]USDA-NRCS, 1990. *Engineering Field Manual*.
[b]Use hydrologic group B for soils where subsurface drainage systems have been installed to improve naturally poor drainage conditions.
[c]For cultivated crops, percent residue cover after planting.
[d]Based on pastures in "fair" condition (50-75% ground cover and not heavily grazed).
[e]Meadows, native prairie, golf courses, and similar areas.
[f]Based on a woodland in "fair" condition (50-75% ground cover and not heavily grazed).

Table 5. Applied Phosphorus Worksheet

This worksheet is used to assess the risk of a direct loss of applied P. The worksheet has a separate calculation for P fertilizer or manure surface applied in winter an non-winter periods. For injected manure, a value of zero will be derived.

NON-WINTER APPLICATIONS (April 01-November 14)

Enter the amount of surface applied fertilizer applied in lbs P_2O_5/ac	**1.**	
Enter the amount of surface applied manure in T/ac or 1000 gal/ac.	**2.**	
Enter the P_2O_5 content of the surface applied manure (from analysis or Table 8) - lbs P_2O_5/T or lbs P_2O_5/1000 gal	**3.**	
Multiply line 2 by line 3	**4.**	
Add line 1 and line 4	**5.**	
Enter the value that most closely matches the incorporation method ***Tillage* — *P Fraction at surface*** ***Chisel*** ***Twisted* 0.25** ***Straight* 0.35** ***Sweeps* 0.45** ***Disk*** ***Small* 0.5** ***Large* 0.4** ***Inject* 0** ***Moldboard* 0.05** ***No Incorporation* 1.0**	**6.**	
Multipy line 5 by line 6	**7.**	
Multiply line 5 by 0.044	**8.**	

WINTER APPLICATIONS (November 15-May 31)

Enter the amount of surface applied fertilizer applied in lbs P_2O_5/ac	**7.**	
Enter the amount of surface applied manure in T/ac or 1000 gal/ac.	**8.**	
Enter the P_2O_5 content of the surface applied manure (from analysis or Table 8) - lbs P_2O_5/T or lbs P_2O_5/1000 gal	**9.**	
Multiply line 8 by line 9	**10.**	
Add line 7 and line 10	**11.**	
Multiply line 11 by 0.44	**12.**	

Table 6. Fall Soil Condition Factors for Snowmelt Runoff Transport[a].

	Tillage and Planting Orientation[b, c]	
Type of Tillage	Up and Down Slope	Cross Slope/Contour
No Till	1.00	0.75
Ridge Till	0.75	0.40
Fall Disk	0.75	0.60
Chisel Plow	0.60	0.40
Moldboard Plow	0.30	0.20

[a]Based on data from Ginting et al., 1998; Hansen et al., 2000; Hansen et al., 2001; Munyankusi, 1999.

[b]Use No Till values for pasture, CRP, and similar conditions.

[c]For relatively flat fields, use the Cross Slope/Contour column.

Table 7. Estimated P Content of Surface Crop Residue Following Different Crops,

Yields, and Fall Tillage Operations.

		Surface Residue P After Fall Tillage					Surface Residue P After Fall Anhydrous Ammonia				
Crop	**Yield**	**NT**	**RT**	**CP**	**MP**	**DISK**	**NT**	**RT**	**CP**	**MP**	**DISK**
	bu/ac	---------------------- lb P/acre ----------------------					---------------------- lb P/acre ----------------------				
Corn[a]	80	5.2	5.2	2.2	0.2	3.4	4.3	4.3	1.5	0.2	2.3
	100	7.5	7.5	3.2	0.3	4.8	6.2	6.2	2.2	0.3	3.3
	150	10.0	10.0	4.2	0.4	6.5	8.2	8.2	2.9	0.4	4.5
	180	12.5	12.5	5.3	0.5	8.1	10.3	10.3	3.6	0.4	5.6
Soybeans[a,b]	30	1.9	1.9	0.3	0.1	0.6	0.5	0.5	0.1	0.0	0.2
	40	2.6	2.6	0.4	0.1	0.8	0.7	0.7	0.1	0.1	0.3
	50	2.8	2.8	0.6	0.2	1.0	0.9	0.9	0.2	0.1	0.4
	60	3.8	3.8	0.6	0.2	1.1	1.1	1.1	0.2	0.1	0.5
Wheat[a]	40	3.2	3.2	1.1	0.1	1.7	2.2	2.2	0.8	0.1	1.1
	60	4.0	4.0	1.4	0.1	2.1	2.8	2.8	1.0	0.1	1.4
	80	4.3	4.3	1.8	0.1	2.7	3.5	3.5	1.3	0.1	1.8
Oats[a]	80	5.6	5.6	2.6	0.2	3.7	4.8	4.8	1.7	0.2	2.6
	100	8.7	8.7	4.1	0.3	5.8	7.5	7.5	2.7	0.3	4.1
Barley[a]	65	3.1	3.1	1.2	0.1	1.8	2.4	2.4	0.9	0.1	1.3
	100	5.3	5.3	2.1	0.2	3.1	4.1	4.1	1.5	0.1	2.2

Crop or other permanent vegetation	**Yield or stocking density**	**Standing vegetation in the fall**	**P in surface vegetation**
	tons/acre or animal units/acre	dry wt (tons/acre)	lb P/acre
Alfalfa and other forages[c] (2 yield levels)	4	0.5	3
	8	1.0	6
Pasture[d] (3 stocking densities)	1.5	0.25	1
	1	0.5	2
	0.75	0.75	3
CRP and other ungrazed permanent vegetation[e]		3.0	12

[a]Estimates of residue P calculated using data from: Halsey, 1986; Wischmeier, 1973; Hanway and Olsen, 1980.

[b]P content of surface soybean residue assumes that leaf P is leached into the soil before the soil freezes.

[c]Values estimate the amount of P in fall re-growth for alfalfa, grass, or mixed forage stands that will be over-wintered and remain in hay the following year. Assumes a P concentration in re-growth of 0.3% for both legumes and grasses. Mays et al., 1980.

[d]Assumes pastures are primarily grass with an average P concentration in ungrazed fall growth of 0.2%. Mays et al., 1980.

[e]Assumes an average P concentration of 0.2%.

Table 8. Approximate Phosphorus (P_2O_5) Content[a] of Manure from Different Types of Livestock and for Different Management Conditions.

Solid Manure			Liquid Manure		
Animal Species	**P_2O_5**		**Animal Species**	**Waste Handling System**	**P_2O_5**
	lb/ton				lb/1000 gal
Swine	8		Swine	Slurry[b]	35
Dairy	3			Anaerobic lagoon	2.2
Beef	4		Dairy	Slurry[b]	15
Poultry	46			Anaerobic lagoon	2.7
Turkey	50		Beef	Slurry[b]	17
Sheep[c]	10			Anaerobic lagoon	2.9
Horse[c]	4		Poultry	Slurry[b]	43
				Anaerobic lagoon	3.6
			Turkeys	Slurry[b]	39

Manure P from Grazed Livestock[d]	
Animal Species	**Annual P_2O_5 on Pasture Surface**
	lb/acre per animal unit[e]
Dairy	29.7
Beef	31.2
Sheep	30.4
Horse	16.7

[a]Values adapted from MidWest Plan Service, 2001.

[b]Underfloor pits, outdoor storage tanks or basins, and continuous pumping systems with drag-hose injection.

[c]MidWest Plan Service, 1993.

[d]Assumes an annual grazing season of May 15 to Oct. 15.

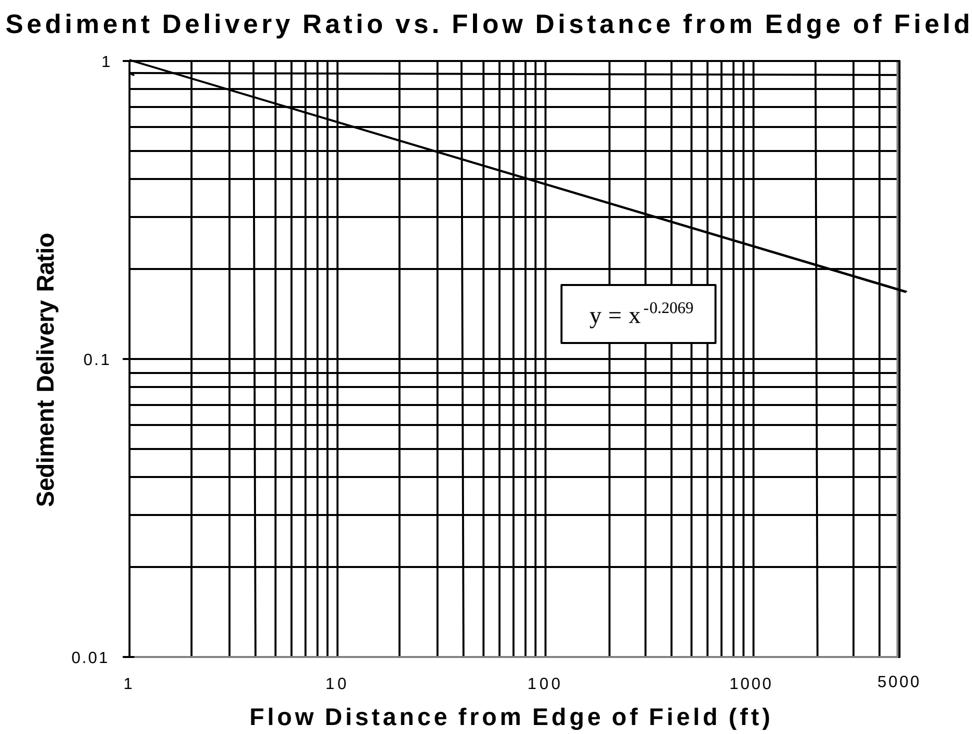
[e]One animal unit is 1,000 lb of any type of livestock.

Table 9. Interpretation of P Index Total Risk Score.

P Index Score	Relative Risk	Recommended Changes
0 to 1	**Very Low**	**None**
1 to 2	**Low**	**None**
2 to 4	**Medium**	**Small Improvements in Management**
4 to 6	**High**	**Moderate Improvements in Management**
>6	**Very High**	**Large Improvements in Management**

Figures

Figure 1. SDR vs. Flow Distance from Edge of Field. Use the 5000 ft. value (SDR = 0.17) for flow distances greater than 5000 ft.



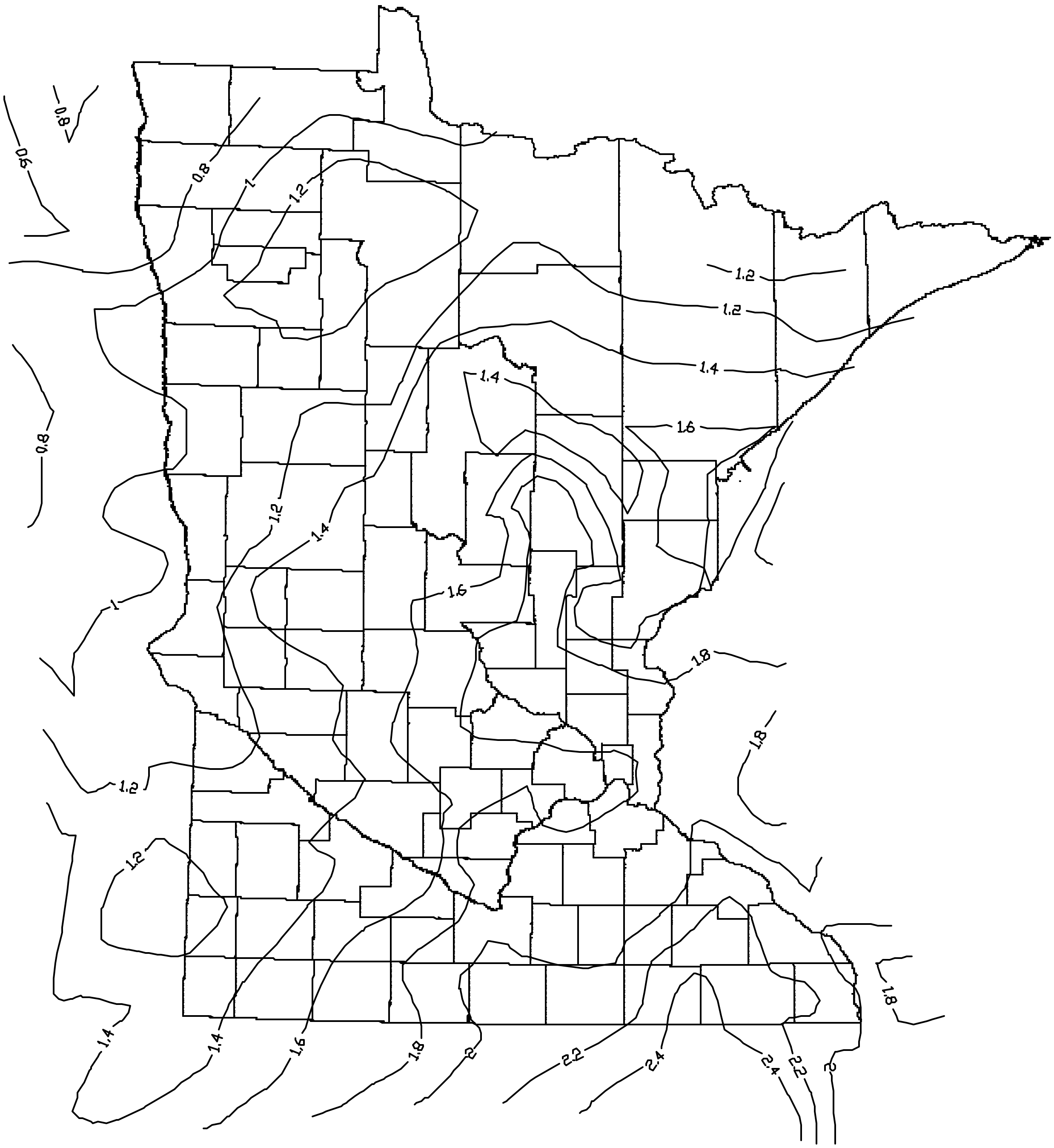


Figure 2 – Estimated Base Rainfall Runoff (from Minnesota NRCS, unpublished). Assumes RCN (Runoff Curve Number) of 78 and Average Hydrologic Condition (Infiltration Capacity).

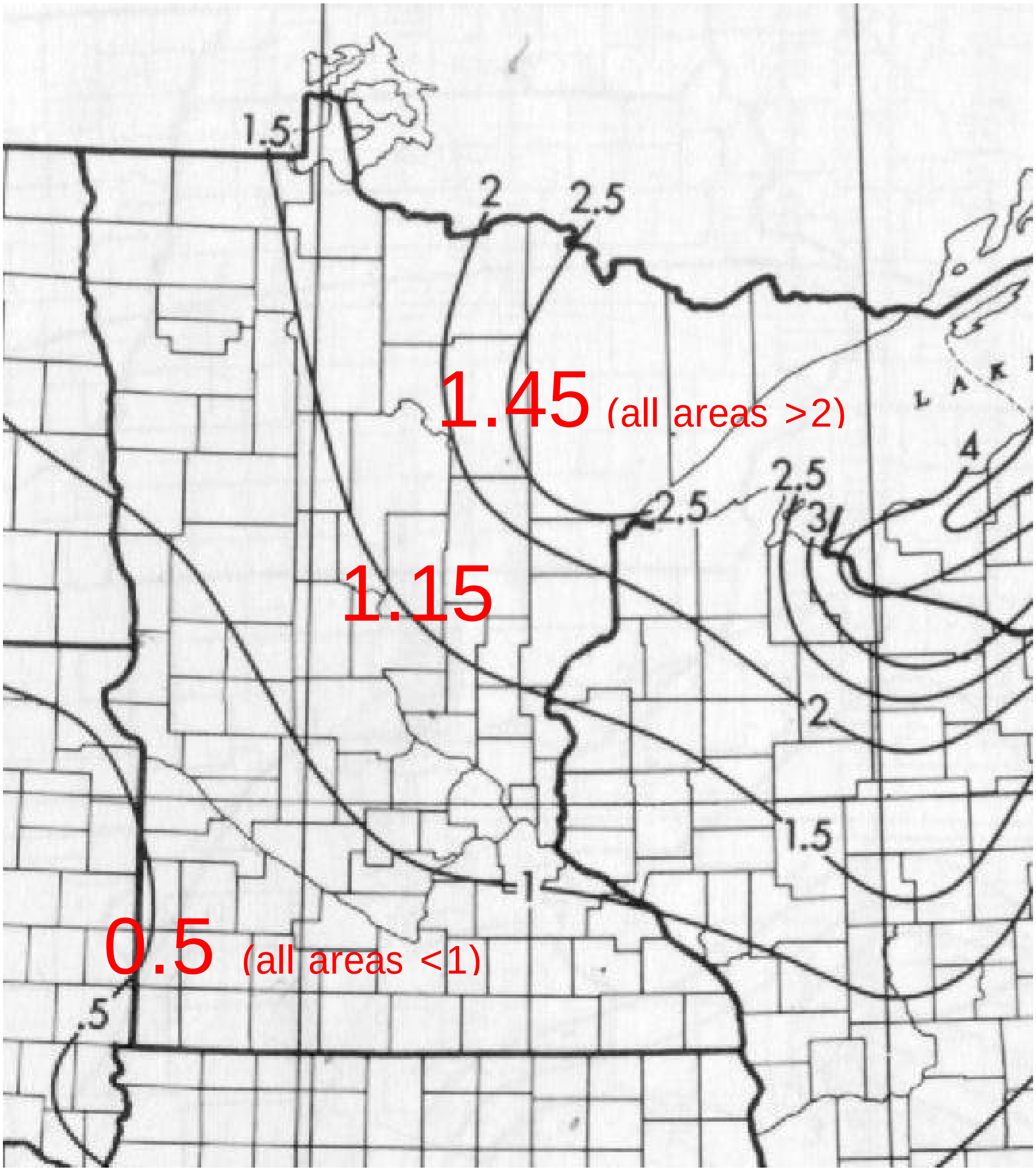

1.5
2
2.5
1.45 (all areas >2)
4
2.5
2.5
3
1.15
2
1.5
1
0.5 (all areas <1)
.5

Figure 3. Snowmelt Runoff Factors for Different Regions of Minnesota. Regions separated by Average Snow Water Equivalent Isolines for March 16-31. (Source: USDC – Weather Bureau Technical Paper No. 50: *Frequency of Maximum Water Equivalent of March Snow Cover in North Central United States*).