EVALUATION OF COMPREHENSIVE APPROACHES NEEDED TO IMPROVE THE HANDLING OF FARM ANIMAL MANURE AND BENEFIT THE ENVIRONMENT AND THE FARMING INDUSTRY

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Preface and Acknowledgements

This report is the product of a workshop held at the University of Tennessee Conference Center in Knoxville, Tennessee on May 15-17, 2000.

The workshop was convened by:

- The Joint Institute for Energy and Environment,
- The Alliance for Environmental Stewardship: A Comprehensive Approach, and
- The National Research and Extension Initiative of the U.S. Department of Agriculture CSREES, Land Grant Universities and Partner Agencies “Animal Waste Initiative: Promoting Environmental Stewardship”

The findings in this report were widely supported by the attendees at the meeting. However, this does not mean that everyone agreed on everything.
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1. Executive Summary

The farm animal industry is a vitally important contributor to the economy and security of the United States, producing low-cost eggs, meat, and milk. An inevitable by-product of this industry is manure. Manure is a valuable resource for nutrients, has soil enhancement properties and, separately, may be used for energy. The effective recycling of this resource is essential.

As the industry has evolved, the production of animal food products and manure has become more concentrated and, in many places, separated from the areas that can handle the manure using the traditional approach of land application. Further, tightening environmental regulations to protect water resources are decreasing the profitability of producers under the present product marketing system. The lack of a comprehensive set of policies, regulations, penalties and incentives compounds the problems of the industry. The problems are aggravated further by public concerns and misconceptions about producers and about the industry in general.

Actions are needed to reform the U.S. system and to protect this important contributor to the well-being of the United States. Failure to act decisively could lead to closure of many farms owing to the difficulty of obtaining the capital investment needed to meet environmental regulations. In turn, this could lead to the movement of production to other countries that are less safety conscious and accept a less environmentally sound industry.

The contributors to this report have a vision of “environmentally sustainable food animal operations that are, safe, socially acceptable, and profitable.” A primary obstacle to realizing this vision is the difficulty for the producers in transferring the real cost of meeting environmental expectations to the consumers.

Fortunately, there are a number of complementary routes to rectifying some of these problems, including:

- a more systematic approach to policy, regulation, penalties and incentives;
- an improved nutrient recycling system;
- the utilization of value-added, bio-solid and bio-energy products;
- voluntary programs for environmental certification coupled with environmental labeling and premium prices; and
- enhanced assistance programs tailored to meet the needs of farmers and for public education.

However, even with these offsets for producers’ costs, it is likely that for many of the farms a more direct approach to paying the real cost will be needed. Specifically, the consumers should pay realistic prices for the products and support government programs that ensure the optimum use of the manure.

This report, developed by a widely based group of stakeholders, makes recommendations in the areas described above for a few key actions needed to achieve this vision.
2. **Summary of Recommendations and Actions**

The principal recommendations and action items, derived in the six main working groups, are combined for simplicity and are presented below. More details on them can be found in section 4, the workshop report. Definitions of acronyms are provided in Appendix C.

**Recommendation 1—Realistic Pricing:** Transfer the real costs of environmental compliance to the consumers, by:

- performing analyses of the lifecycle costs of meeting environmental expectations;
- direct pricing (with the additional revenue going to the producers responsible for environmental investments) and, indirectly, by subsidies in one form or another;
- creating a sustainable program that is self-funded after start-up to fund the integrated waste management systems for Concentrated Animal Feeding Operations (CAFOs) and groups of smaller Animal Feeding Operations (AFOs) using economic incentives;
- providing a credit system for reducing greenhouse gases similar to that for sulfur oxides; and
- creating a voluntary approach to better product labeling, supported by certification and consumer education programs.

Practical limits on subsidies related to environmental costs will be needed. The intent is not to support inappropriate production. Further, subsidies should not be allowed to distort the market e.g., by distinguishing between different products. Offsets to the producer’s costs necessary to improve environmental quality can come from optimizing the mass balance of nutrients and other manure components, introducing value-added products, and improving policies and regulations.

**Recommendation 2—Optimize the Mass Balance:** Maximize the beneficial use of animal manure and commercial fertilizers to minimize environmental impacts. Develop an approach to ensure a level playing field for the use of animal manure and remove differences among the various states by:

- balancing nutrients (phosphates and nitrogen) on individual (or groups of) production units, minimizing nutrient losses while supporting actions with incentives;
- expanding tax incentives in IRC Section 45 to include all agricultural waste;
- involving all stakeholders and improving their knowledge of nutrient management concepts;
- providing consistency and clarity in regulations while eliminating inappropriate regulations;
- improving measurements and analyses that characterize manure and soils, monitor pollution levels, and support the science-based information with regulations that have realistic and measurable standards;

**Recommendation 3—Value-Added Products:** To reach our vision for value-added products, it is necessary to support efforts to move existing technologies into the marketplace as well as increase research development & demonstration (RD&D) funding for new technologies.
Policies are needed that encourage both developments for handling manure and manure based products, and approaches for offsetting the cost of systems that improve air and water quality. Therefore, it is necessary to:

- fully fund the President’s proposed bio-solids and bio-energy initiative for commercialization of existing technologies ($200 million/year); and the Lugar Bill for RD&D on commercially viable technologies ($49 million/year for five years);
- develop state and private sources of funding for developing and demonstrating manure-based value-added products. The Government should work with the private sector to embrace development and marketing of value-added products by:
  - developing performance standards and certifications for “green” manure-related, value-added products;
  - developing a clearinghouse to publish unbiased assessments on manure-related, value-added products; and
  - developing a need for innovative manure-related, value-added materials beyond the traditional fertilizer and energy products, and develop extension services.
- Create tax incentives for adoption of technologies that promise equal or greater economic return while protecting the environment, and subsidies to remove obstacles and promote the use of value-added products from manure.

Recommendation 4—Policies and Regulations: A comprehensive farm and environment bill is needed. It should encompass a major update and consolidation of regulations to address today’s needs and capabilities on a national and state basis, including the Clean Water Act, Clean Air Act, Safe Drinking Water Act, Coastal Zone Act Reauthorization Amendments, etc. A regulatory review process, like Muskie’s Bill 1972 pl. 9250, is needed. As in a number of related cases, there should be a sunset provision for all regulations. Therefore, it is necessary to:

- Coordinate air quality and odor standards and regulations with surface water, groundwater, and soil regulations for a comprehensive systems approach to addressing the overall environmental issues associated with using animal waste with:
  - regulations founded in sound science, designed for flexibility, and equitably and consistently applied;
  - regulatory enforcement undertaken in conjunction with compliance attainment guidance via technical assistance, dissemination of best management practices (BMP) and best available technology (BAT) information and sustainability support;
  - basic research to determine the cause and effect of air contaminants, pathogens, antibiotics and hormones associated with AFOs on human health and the environment to subsequently establish odor, air, and water standards;
  - quantification of the total economic impact of improved waste management via a whole costs/benefits accounting analysis of the value of environmental protection and restoration; and
  - education of the various stakeholder groups to the vision, goals and methods for attaining a clean environment and sustainable, profitable animal production systems.
Public Law 105-185 (1998), the Agricultural Research, Extension and Education Reform Act (Section 243), authorized a Nutrient Management Research and Extension Initiative to be implemented by USDA/CSREES with land grant universities and other stakeholders. This initiative should receive appropriations to fully implement its program to address the priority issues addressed here.
3. Target Audience and Action Items

**Congress and the White House**—Establish a National Advisory Board and set up a National Research Council Review.

**Legislators**—Provide a comprehensive, consistent system of policies, regulations, and incentives, solidly grounded in science, that will ensure that a realistic price is paid for animal products. Ensure regulatory flexibility. Classify animal waste as a renewable resource and encourage its use by supporting loan programs and tax credits, emissions trading programs, and encouraging the government procurement of manure products. Provide support for the research, development and demonstration needed to realize this vision.

**Federal/State Agencies** (e.g., USDA, DOE, EPA and economic development agencies)—Provide financial support and background information, SBIR topics, well-targeted solicitations, a technology clearinghouse, and assessment protocols. Support science-based, unbiased, consumer education.

**State Agencies**—Provide a fair taxation system and tax credits for the utilization of manure and manure products. Support consumer education and extension services for producers.

**State Regulatory Agencies**—Develop a consistent environmental permitting system and take some responsibility to encourage training to facilitate compliance. Deal with impediments to distributed power use.

**Utilities**—Show a willingness to support the production of manure-based energy.

**Animal Agriculture Producers**—Make a commitment to and cooperate to improve manure management practices.

**Crop Producers**—Support the responsible use of nutrients and fiber from all sources.

**Integrators**—Support producers in achieving profitability while meeting the required environmental quality. Play an active role in recycling manure. Support the development, demonstration and adoption of value-added technologies.

**Trade Associations**—Support educational programs, certifications and compliance.

**Allied Industries**—Make a financial commitment to RD&D for improved manure management practices.

**Brokers and End-Users of Manure-based Products**—Support development and implementation of better approaches for handling manure, i.e., manure banks, fertilizers, value-added bio-solid products, bio-energy, bio-chemicals from all farm wastes.

**Universities**—Support all producers through outreach programs, education and RD&D.
**Green Certification Organizations**—Create science-based and philosophically consistent certification guidelines. Certify animal products and manure-based products that are produced in an environmentally sound manner so that they may demand a premium price.

**Constituents generally** (producers, integrators, trade associations, states, technology suppliers, allied industries, educational and research community, rural communities, etc.)—Solicit support and obtain buy-in for programs to improve the industry. Support education programs. Hold forums on a regional or watershed basis to build consensus on animal farm system goals and needs to protect the environment
4. **Workshop Report**

4.1 **Introduction**

The workshop on the “Evaluation of Comprehensive Approaches Needed to Improve the Handling of Farm Animal Manure and Benefit the Environment and the Farming Industry,” held in Knoxville, Tennessee on May 15-17, 2000, was convened by:

- The Joint Institute for Energy and Environment;
- The Alliance for Environmental Stewardship: A Comprehensive Approach; and

The advisory committee for the Alliance for Environmental Stewardship (see Appendix B) was consulted about the goals and approach of the meeting. The membership of the National Research and Extension Initiative Committee is also shown in Appendix B.

Experts attended from a wide variety of stakeholder groups associated with or interested in animal agriculture. The attendees and their affiliations are shown in the participants list (section 4.8). Comments on the report were obtained from an even broader group of people who were not able to attend the meeting.

The meeting agenda is shown in section 4.9 below. After three talks to set the stage, the participants were split into six groups to discuss topical areas. Initially there were three groups on Farms of the Future (cattle, hogs, and poultry), and a group each on Environment, Mass Balance, and Value-added Products. Later the groups were Farms of the Future (consolidated), Economics, Policies and Regulations, Environment, Mass Balance, and Value-added Products. Participants were able to shift to different groups at this time.

Plenary sessions were used to combine the output of the groups and provide focus for subsequent discussions. Each group was asked to consider the points below and develop, collectively, a few key recommendations and action items, such as:

- a vision statement;
- a list of stakeholders and what is needed of each of them;
- a list of obstacles to attaining the vision(s);
- a list of solutions, existing and needed, to overcoming the obstacles;
- RD&D needs for existing, improved, and new solutions;
- lists of support programs—existing, improved, and new
- possible revised or new policies and programs;
- comments on overall coordination—Federal, state, local, etc;
- Input to target audiences; and
- Other?
To assist in this venture, a summary was provided of the findings of seven previous workshops. This summary, now including the detailed findings of this workshop, is in Appendix A. The principal conclusions of the final six groups follow.

4.2.  Farms of the Future

Our vision is for environmentally sustainable food animal production operations that are safe, socially acceptable, and profitable.

A fundamental obstacle to achieving this vision is inadequate valuation of environmental resources. Although many producers do implement good environmental practices—there is little financial incentive to do so given the current market structure and technology choices. To overcome this obstacle and achieve the vision, we make the following two recommendations:

Recommendation 4.2.1: Provide incentives to producers by transferring costs of meeting the vision to consumers. A voluntary approach to this involves better product labeling supported by certification and consumer education programs. Such green labeling approaches would allow producers to recover costs for producing food in more environmentally sustainable ways. Another approach is for government to provide financial incentives for farmers to implement technologies and management practices. This approach could be funded through several means. A tax on animal products collected at the retail point of sale, and transferred directly to producers on a manure-produced basis would be a long-term solution. A carbon tax would increase fertilizer costs, increase manure values, and potentially transfer significant funds to farmers who use environmentally sustainable practices (e.g., conservation tillage, appropriate fertilization rates, methane capture from animal wastes). As with the animal-products tax, this tax would be a long-term solution. Finally, a short-term method of raising funds would be to provide government subsidies, such as a revolving loan fund, to farmers who implement environmentally sustainable practices (e.g., FEMP procedure, see section 4.3).

Recommendation 4.2.2: Improve environmental regulations on farms. Make them simpler, unified, universal (i.e., nationwide), and then enforce them. Since all fields are not created equal, some inequities may result from universal environmental regulations. However, the fact that local soil and atmospheric conditions differ should not be used as a reason to have poor environmental compliance at any one site. Ensure that all regulations are science-based, and periodically verify that all farms are in compliance, perhaps by third-party verification or self-reporting under the ISO 14000 standard. Have sunset provisions for all regulations. Base comprehensive nutrient management plans on a nutrient mass balance, and consider the entire operation (including housing and storage) when developing these plans.

Achieving environmental compliance will require partnering with other groups. In addition to the public, agribusiness sectors such as energy production, insurance agencies, fertilizer manufacturers, and marketing experts have significant interests in this area. Furthermore, the efforts of individual entrepreneurs and the participation of non-governmental organizations are needed to ensure that the vision can be realized.
Many of the elements for farms of the future that could meet our vision exist or could be developed. For situations where there is not a good match between manure production and local need, there are additional activities that might be undertaken. In general, what is required is a better-integrated system that involves other areas of farming and waste management. Some examples with potential to improve profitability and environmental quality include:

- combining the animal production with other crops that require a relatively smaller land area to absorb the nutrients;
- composting and co-composting leading to designer composts and pelletizing;
- co-firing the dry manure with coal or burning it directly, using the ash as a fertilizer component;
- coupling the production to some energy product such as electricity and/or process heat, or to corn plus ethanol production or chemical products;
- having a system (e.g., a manure bank) to collect and handle manure in bulk rather than on a farm-by-farm basis; and,
- ultimately, developing an economic procedure for concentrating the nutrients so that they may be recycled more readily.

Often, such approaches can be economic because they achieve more than one goal. For example, if manure is digested in a closed container to produce methane, this methane may be used to produce electricity and process heat. The cost of the electricity may be somewhat higher than electricity from the grid. However, the process heat has value and the closed digester can reduce substantially or eliminate odors from storage and when the residuals are used as nutrients on fields. Further, the process of digestion can substantially reduce pathogens. In assessing the economics of various solutions it is important to consider all of the value-added aspects. Finally, a farm may choose to incorporate other waste streams such as gray water from industrial processes, or municipal sewage sludge, or residuals from other agricultural crops.

### 4.3 Economics—A Possible Support Program

Our vision is the creation of a sustainable program that is self-funded after start-up to fund integrated waste management systems at CAFOs using economic incentives. Non-partisan political buy-in is a necessary condition for success.

**Recommendation 4.3.1:** Establish a shared-savings program based upon the Federal Energy Management Program (FEMP) model; have a “National Environmental Fund.” This would be a revolving fund with low or no interest loans. It would be auditable, certifiable, performance-based, and have a service contract potential.

- **Cost:** The total CAFO environmental improvement costs alone are estimated to be in the range of $20-$40 billion. A 10-year program is envisioned with start-up funds of about $1 billion with $1 billion added each year thereafter for a 5-year period.
Who qualifies: CAFOs would qualify and AFOs to the extent that they were not covered by other programs such as EQIP.

System providers: The work of providing improved environmental management would be undertaken by certified technology providers using performance based technologies.

Operations: The operation of the systems would be undertaken by producers, co-operatives and ESCOs. The approach would have to ensure that producers could handle the operation costs.


How does it work? There would be a 90-10 shared savings until pay-out (90% to the organization that invested in the system and 10% to the producer). To encourage the process, the government could buy “green products” and increase economic performance with accelerated depreciation schedules and kWh wheeling.

The Federal Energy Management Program (FEMP) achieves its goals of improving the efficiency of energy use and encouraging renewable projects in Federal facilities and operations through identifying opportunities, financing, and implementing energy efficiency and renewable projects. In addition, FEMP provides technical assistance through SAVEnergy audits, evaluates project proposals, provides up-front engineering and design support, and assists in measuring and verifying energy savings for these projects. FEMP also develops analytic tools and information to assist in identification and selection of cost-effective projects and products.

4.4 Mass Balance

The goals for this area are to have some form of incentive payments to encourage the recycling of nutrients. Incentives need to be reinforced by regulations, educational support and equitable enforcement of the regulations. Standardization methodologies and improved instrumentation technologies are required to support and encourage nutrient recycling.

An inevitable consequence of consuming animal products is the generation of manure. Manure is a valuable resource for nutrients, soil enhancement, bio-products and specialty chemicals more generally and, separately, for using its energy. The effective recycling of this asset is essential. More work is needed to understand the behavior of the various constituents (e.g., nitrogen, phosphorus, metals, etc.) as they travel through the system, from feed production to manure production and use, so that optimum decisions can be made about changing the system. Problems occur when the level of manure production exceeds that which can be accommodated locally by traditional land application methods. A primary difficulty is the much higher mass per unit of nutrient value compared to commercial fertilizers, which makes it less economic to ship long distances. Policies are needed that will direct excess manure to places where it is
needed and encourage the development of other beneficial uses. The generation of high-value products (e.g., other crops, bio-products, specialty chemicals, and bio-energy) and techniques for concentrating the nutrients can ameliorate the problems. Further, some current tax policies penalize manure use relative to commercial fertilizers.

**Recommendation 4.4.1**: Ultimately, consumers must pay the real costs of meeting tightening environmental requirements and the concomitant improved recycling of nutrients. Revenue sources should be generated directly through product pricing (with the additional revenue going to the producer) and also indirectly by taxation in some form or other. Practical limits on subsidies related to environmental costs will be needed, because the intent is not to support inappropriate production. Further, subsidies should not be allowed to distort the market (e.g., by distinguishing between different products).

The necessary stakeholder involvement includes the following:

- Government has a central role to play in effecting and managing the recommended changes in nutrient recycling;
- Land grant universities will be involved in research, education and extension services (e.g., demonstration programs);
- Producers will be involved in cooperative research and demonstration programs as well as in the development and implementation of nutrient management plans;
- Integrators must accept partial responsibility and play an active role in recycling nutrients; and
- The private sector, generally, has to increase its involvement in recycling efforts, and increase support of research, development and demonstration efforts.

### 4.5 Value-Added Products

**Vision**: Implement fully integrated animal waste management collection and processing of by-products into socially acceptable and economically valuable resources.

**Goals**:

- Increase the number of AFOs implementing integrated waste management systems (voluntary or regulatory) for bio-based products and bio-energy by 50% by 2010.
- Increase the acreage relying on manure-based value-added fertilizers by 50% by 2010.
- Increase the use of manure-based bioproducts by 20% by 2010.
- Measure the impact of livestock production as a pollution source in watersheds affected by excess nutrients.

**Stakeholders and what is needed from them**:

- Animal agriculture producers—should make a commitment and cooperate to improve waste management practices.
- Crop producers should support responsible use of manure nutrients and fiber.
- Allied industries should make a financial commitment to RD&D for improved management practices.
Regulators should strive in their regulations for flexibility within a specific set of rules. Government should strive for consistency and flexibility in policies for manure management and energy production, support bio-based initiatives and sponsor transparent assessments of existing and new technologies for this area. Politicians should consider the use of carbon credits and carbon trading programs that could help encourage the better use of manure products. Other stakeholders (including consumers, educators, environmental interest groups, financial organizations, R&D community, rural communities, technology suppliers, and utilities) should support a comprehensive approach to making better use of manure, adding value while minimizing pollution.

Obstacles: An underlying problem, as indicated above, is the poor connection of the price paid to producers and their real costs, which are increasing as environmental regulations are tightened. The problem is exacerbated by the consumption habits of consumers that are driving increased production. This problem is made worse by the particular difficulty for small farms to invest in technologies for managing wastes and the competing demands for land that locate housing estates in traditional farming areas.

The extent to which some producers do not recognize the present problems in manure management is an impediment, as is their natural risk aversion in adopting new technologies. Moreover, the immature state of many technologies and the lack of an infrastructure to support the producers who use them makes matters worse. Regulatory uncertainty and change compound the difficulties.

Products:
- Inputs—manure, litter, dissolved air flotation (DAF) solids, mortalities, blood, offal (includes feathers), packing materials, other organic wastes.
- Outputs—animal feed (coprophagy versus pet food), energy (power and fuels), compost, fertilizers, specialty chemicals, materials (e.g., for buildings), and cost avoidance.

Potential solutions:
- Incentives for implementers of best management practices required to meet the vision.
- Government-backed loans.
- Changes in government procurement regulations.
- Government follow-up to buy “green” energy products and bio-products such as compost.
- Investment tax credits for RD&D on improved manure management practices.

Recommendation 4.5.1: To reach our vision for value-added products, it is necessary to support efforts to move existing technologies into the marketplace as well as increase RD&D funding for new technologies. Therefore, the following are necessary:

- Fully fund budget proposals supporting the President’s biobased products and bioenergy initiative for commercialization of existing technologies ($200 million/year); and the Lugar bill for RD&D ($49 million/year for 5 years).
- Develop state and private sources of funding for developing and demonstrating manure-based value-added products.
Target audience and action items for Recommendation 5.1:

- Legislators: ACTION—provide funding.
- Federal/State agencies (e.g., USDA, DOE, EPA and economic development agencies): ACTION—provide support in information, SBIR topics, well-targeted solicitations, a technology clearing house, and assessment protocols.
- Constituents (i.e., all stakeholders: producers, integrators, trade associations, states, technology suppliers, allied industries, research community etc.): ACTION—solicit support and obtain buy-in.

Recommendation 4.5.2: The Federal Government should work with the private sector to embrace the development of value-added products by:

- developing performance standards and certifications for “green” manure-related, value-added products;
- developing a clearinghouse to publish unbiased assessments on manure-related, value-added products; and
- developing a need for innovative manure-related, value-added materials beyond the traditional fertilizer and energy products.

Target audience and action items for Recommendation 5.2:

- Legislators: ACTION—provide regulatory flexibility, classify animal waste as a renewable resource, support loan programs, taxes and tax credits and encourage government procurements of manure products.
- State agencies: ACTION—support consumer education and extension services for producers.
- State regulatory agencies: ACTION—deal with impediments to distributed power use, and make consistent environmental permitting.
- Utilities: ACTION—show a willingness to purchase manure-based energy.
- Trade associations: ACTION—support education programs and certifications.
- Brokers and end-users of manure-based products: ACTION—show a willingness to buy.
- Green certification Organizations: ACTION—certify manure-based products that are produced in an environmentally sound manner.

4.6 Environment

Goals:

- To develop waste management system regulations that protect water, air, and soil quality that are based on sound science and technology.
- To develop the science and practical technology that addresses environmental issues associated with animal production in an integrated systems approach.
- To provide stakeholders the education, guidance, and assistance necessary to attain regulatory compliance.
Recommendation 4.6.1—Regulations: Coordinate air quality and odor standards and regulations with surface water, groundwater, and soil regulations for a comprehensive systems approach to addressing the overall environmental issues associated with animal waste. This comprehensive approach should address all areas of environmental concern while protecting regulated entities that are in compliance.

Regulations must be founded on sound science. They must be equitably and consistently applied yet designed for flexibility according to regional watershed conditions, facility size, and production category (poultry, cattle, fish, etc.).

Regulatory enforcement must in conjunction with compliance attainment guidance via technical assistance, dissemination of best management practices (BMP) and best available technology (BAT) information and sustainability support.

Recommendation 4.6.2—Research and Development: Basic research needs to determine the cause and effect of air contaminants on human health and the environment to subsequently establish odor and air standards for animal feeding operations.

Research needs to be conducted to determine the scope and impact of pathogens, antibiotics and hormones associated with animal feeding operations on human and animal health.

Continued R&D is needed on improved integrated systems of waste management technologies including innovative nutrient recycling methods in conjunction with natural system solutions (buffer strips and wetlands).

Definitive, science based groundwater/surface water interaction standards must be developed.

Continued research is needed on animal science approaches to waste minimization (i.e. feed additives, genetic engineering of both feed and animals, natural hybrids, diversification of feed and livestock).

Regional/watershed land use research should lead to the development of carrying capacity models and standards for limits of both point and non-point sources of nutrients from agricultural and other contributing operations.

Quantification of the total economic impact of improved waste management via a whole costs/benefits accounting analysis of the value of environmental protection and restoration due to reduction of the waste stream/nutrient loss. This would include, but not be limited to, taking into account value-added products, cleaning the environment, reducing health problems, decreasing costs associated with fish kills, recreational water clean-ups, and the value of intangible quality of life improvements.

Lead groups in coordinating this effort would be EPA, USDA, H&HS (health issues research), and departments of economic development for financing the value-added products entrepreneurs. DOE should take the lead for the energy conversion of the bio-mass and bio-solids.
Recommendation 4.6.3—Education: To achieve environmental protection goals, it is necessary to educate the various stakeholder groups to the vision, goals and methods for attaining a clean environment and sustainable, profitable animal production systems. Educational programs should be complementary and integrated across the private and public sector stakeholder groups. Farm*A*Syst is an example of a process that allows producers to take the lead in the planning process.

The general public must understand there is a direct link between the consumer food choices and the state of the environment. Consumers must be educated to the costs of maintaining a high quality food supply while protecting the environment.

Environmental protection groups should be enlisted to share responsibility with commodity groups and facilitate constructive information exchange between their constituents, the agricultural community and regulators.

Related governmental agencies from the local to the federal levels must coordinate their educational efforts to reach out, equitably and openly, to all of the stakeholder groups. The fundamental commonality should be recognition that improved waste management means improved environmental conditions.

Regulators must take some responsibility in ensuring proper and adequate training and support is available to those they regulate so standards can be met with minimum conflict and maximum results.

The final key group to be educated to the need for more appropriations and facilitation of this process are the legislators. Laws and funding must be created that stimulate RD&D as well as cooperative efforts to protect the environment and improve the efficiency and profitability of animal feeding operations.

Public Law 105-185 (1998), the Agricultural Research, Extension and Education Reform Act (Section 243), authorized a Nutrient Management Research and Extension Initiative to be implemented by USDA/CSREES with land grant universities and other stakeholders. This initiative should receive appropriations to fully implement its program to address the priority issues addressed in this document. EPA environmental justice funding should be made available to communities, counties and alternative farming groups for additional projects and programming in educating the stakeholder groups.

Next Step: Stakeholder forums should be held on a regional or watershed basis to build consensus in the three recommendations areas listed above. These regional/watershed specific focus groups should be composed of all stakeholder groups and work on necessary steps to apply the BMP’s, BAT’s and CNMP for local environmental protection and AFO sustainability. National conferences should continue to be supported.
4.7 Policies and Regulations

Vision:

Policies: Develop a set of policies that encourage producers and consumers to promote and support agricultural best management practices that protect human health and the environment while maximizing economic output, jobs, and investment in the industry through the use of incentives or, if necessary, regulations.

Regulations: Develop regulatory processes that are based on the best available and economically achievable technology, using measurable standards to minimize negative impacts on environmental quality and public health with required periodic review and revision.

Recommendation 4.7.1: Develop policies that encourage both infrastructure development for handling manure, and approaches for offsetting the cost of systems for improving air and water quality. Supporting such policies should be:

- incentive payments for a complete farm assessment;
- a compilation of lessons learned from previous policies and regulations;
- support of the Lugar Bill for R&D on technologies that can be commercially viable;
- tax incentives for the adoption of technologies that promise equal or greater economic return while protecting the environment;
- modify Section 45 of the Internal Revenue Code to provide incentives for the use of all agricultural and animal wastes;
- subsidies to remove obstacles and promote the use of value-added products from manure;
- support for the President’s bio-solids and bio-energy initiative;
- encouragement for the preferential use of organic sources of nutrients;
- remediation of fields with nutrient surpluses;
- encouragement for the evolution to an integrated sustainable agriculture system;
- efforts to ensure that policies and regulations are supported by an unbiased, scientific-basis are periodically peer reviewed, and have a sunset provision; and
- improvement of measurements and analyses that characterize manure, monitor pollution levels, define sources of pollution, and support the scientific basis.

Recommendation 4.7.2: Develop an approach to ensure a level playing field for the use of animal manure and remove differences among the various states, including:

- development of a summary of inappropriate outdated regulations;
- providing a definition of a legal discharge;
- achieving consistency in regard to allowable amount of pollution (e.g., ammonia volatilized per acre per year);
- resolving differences between State laws (e.g., North Carolina’s lagoon phase-out and Colorado’s lagoon cover policy);
- allowing no discharge versus having NPDES permit effluent guidelines; and
- having regulations that have realistic and measurable standards.
**Review process:** Regulatory review process, like Muskie’s Bill 1972 PL 9250, is needed. There should be a sunset provision for all regulations.

**Regulatory reform:** A comprehensive farm and environment bill is needed. It could encompass a major update and consolidation of regulations to address today’s needs and capabilities on a national and state basis—including CWA, CAA, Safe Drinking Water, CZARA, etc.

**Contributors:** Congress, Federal and State Governments, Industry Groups, EPA, USDA, DOE, and environmental organizations.

**Actions:**
- Establish a National Advisory Board—Congress, White House.
- Set up a National Research Council Review—Congress, White House, NRC, EPA, USDA, DOE.
- Improve public perceptions—industry associations, producers, integrators, and media.

### 4.8 Workshop Participant List

- Brian Appel, Changing World Technologies, Inc.
- Phillip Badger, General Bioenergy, Inc.
- Kathryn Baskin, Southern States Energy Board
- Paul Baskis, Changing World Technologies, Inc.
- Leslie Behrends, Tennessee Valley Authority
- Jan Berry, Oak Ridge National Laboratory
- James Blackburn, Southern Illinois University, Carbondale
- Bert Bock, Tennessee Valley Authority
- Janet Bonet, Mississippi River Basin Alliance Council
- Richard Bradshaw, U. S. Department of Energy, EE&RE
- Lynn Brickett, U. S. Department of Energy, NETL
- Jack Britt, University of Tennessee, Institute of Agriculture
- Robert Burlage, Oak Ridge National Laboratory
- Robert Burns, University of Tennessee, Agricultural & Biosystems Engineering
- Eldridge Collins, Jr., Virginia Tech, Biological Systems Engineering
- Janet Cushman, Oak Ridge National Laboratory
- Craig Darroch, University of Tennessee, Martin
- Brian Davison, Oak Ridge National Laboratory
- Michael Devine, University of Tennessee, Office of Research
- Cain Diehl, Southern States Energy Board
- Brian Duff, Pinnacle Biotechnologies
- Katie Elmer, Gannett Fleming
- Don Erbach, U. S. Department of Agriculture, ARS/NPS
- Tom Fiesinger, New York State Energy R&D Authority
- Larry Goff, Poultry Water Quality Consortium
Hilda Hatzell, U.S. Environmental Protection Agency, Region 4
Richard Hegg, U. S. Department of Agriculture, CSREES
Steve Hildebrand, Oak Ridge National Laboratory
Frank Humenik, North Carolina State University,
Robert James, U. S. Department of Energy, NETL
Mark Jenner, American Farm Bureau Federation
Barry Kintzer, U. S. Department of Agriculture, NRCS
Philip Lusk, Resource Development Associates
Kent Madison, Madison Farms
Jack Martin, Hall Associates
John McArthur, Battelle
Larry Newton, University of Georgia
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Richard Reynnells, U. S. Department of Agriculture, CSREES/PAS
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David Staples, Creekwood Farms, Inc
Arthur Stewart, Oak Ridge National Laboratory
Richard Strickland, Tennessee Valley Authority
Frank Thompson, Nebraska Public Power District
Virginia Tolbert, Oak Ridge National Laboratory
Robb Turner, Southern Appalachian Man and the Biosphere Cooperative
Fred Varani, EPRI
Forbes Walker, University of Tennessee
Mike Williams, North Carolina State University
Ron Williams, Tennessee Valley Authority
Tim Williams, Water Environment Federation
Nickolas Zimmermann, University of Maryland
Warren Zurn, U.S. Department of Energy, Atlanta Regional Office

Others providing input to the meeting or comment on the report include:
- John Blake, Alabama A&M and Auburn Universities
- David Brubaker, Johns Hopkins, School of Public Health, Center for a Livable Future
Joseph Hoagland, Tennessee Valley Authority
William Satterfield, Delmarva Poultry Industry
James Wimberly, Foundation for Organic Resources Management

4.9 Workshop Agenda

Monday, May 15:

8:30 am  Introductions and Welcome

Sponsor comments:
John Sheffield, Joint Institute for Energy and Environment
Frank Humenik, North Carolina State University
Richard Reynnells, U.S. Department of Agriculture

Welcome: Jack Britt, The University of Tennessee, Institute of Agriculture

8:50 am  Barry Kintzer, U.S. Department of Agriculture—“Comprehensive Nutrient Management Planning”


10:10 am  Break

10:30 am  Hilda Hatzell, U.S. Environmental Protection Agency—“EPA Guidance for Animal Farm Operations”

11:15 am  Instructions to Breakout Groups—John Sheffield

Session A:
A-1 Cattle  Chair Lew Smith, Co-chair Raj Raman
A-2 Hogs  Chair Frank Humenik, Co-chair Tom Richard
A-3 Poultry  Chair Eldridge Collins, Co-chair Richard Reynnells
A-4 Environment  Chair Richard Hegg, Co-chair Steve Hildebrand
A-5 Mass Balance  Chair Barry Kintzer, Co-chair Forbes Walker
A-6 Value-added Products  Chair Mike Williams, Co-chair Janet Cushman

12:30 pm  Lunch

1:30 pm  Continue breakout groups.

4:30 pm  Plenary Session: Review findings and discuss how to proceed
Tuesday, May 16

9:00 am Breakout Groups—Session B continue group discussions

12:30 pm Lunch
1:30 pm Plenary Session: Review findings and discuss how to proceed; reconstitute breakout groups

2:30 pm Breakout Groups

Session C:
  C-1 Farms of Future: Combined Chair Tom Richard
  C-2 Environment Chair Richard Hegg, Co-chair Steve Hildebrand
  C-3 Mass Balance Chair Barry Kintzer, Co-chair Forbes Walker
  C-4 Value-added Products Chair Mike Williams, Co-chair Janet Cushman
  C-5 Economics Chair Philip Lusk
  C-6 Policies and Regulations Chair Bob Harris, Co-chair Richard Reynnells

5:00 pm Plenary Session to discuss progress and make adjustments.

Wednesday, May 17

8:30 am Breakout Groups complete their work and prepare summaries

12:00 End of Workshop.
Appendix A—Summary of Findings of this and Previous Meetings

Including findings from:

- Opportunities to Improve the Handling and Benefit from Farm Animal Wastes, JIEE, Knoxville, TN, March 24-26, 1999
- Alliance for Environmental Stewardship: A Comprehensive Approach, St Louis, MO. September 27-29, 1999
- Animal Residuals Conference Proceedings, Water Environment Federation, Crystal City, VA, November 18-20, 1999
- CSREES Stakeholder Priorities Workshop for Animal Agriculture, Nutrition and Food Safety, Washington, DC, Dec 7-8, 1999
- Evaluation of Comprehensive Approaches Needed to Improve the Handling of Farm Animal Manure and Benefit the Environment and the Farming Industry, Knoxville, TN, May 15-17, 2000

A1. Overall

“Sustainable agriculture is an integrated system of plant and animal production practices that will, over the long term:

- satisfy human food, fiber, and specialty chemicals needs;
- enhance environmental quality and the natural resource base;
- make efficient use of non-renewable resources;
- sustain economic viability of farm operations; and
- enhance the quality of life for farmers, farm families, and society.”

The vision of “environmentally sustainable food animal operations that are, safe, socially acceptable, and profitable” is achievable provided certain actions are taken.

- It is important to balance the competing interests and requirements of farmers, regulators, consumers and the general public.
- It is important to site and operate livestock and poultry operations carefully, and use efficient and cost effective technologies and management practices, so that there are minimum impacts on neighbors and on soil, water, air, and wildlife.
- It is important to coordinate assessments of soil, water, and air quality and the development of educational materials and programs; and coordinate the development of methods for proper management and use of wastes.
- There is no single approach to handling manure productively that can satisfy the wide variety of conditions under which it is produced and the nature of the manure. The various
livestock and poultry operations are different, and the size of farms and their location vary widely. This is also true for the level of management expertise, capabilities and resources.

- The problems of manure handling are solvable with potential benefits to the livestock and poultry industries as well as to the economy and the environment. Government and industry should develop and carry out comprehensive plans for capitalizing on the possibilities.
- The challenges are to capitalize on the existing technological opportunities, undertake RD&D on new opportunities in a timely fashion, and craft policies and regulations that ensure that these technological solutions are available, effective and user-friendly.
- Recognize that most farmers are environmental advocates but lack training and/or financial resources.
- Learn about foreign system successes—don’t reinvent the wheel.

A2. Public Perception, Social Issues, Education, Outreach

There is a public perception of idyllic farms and philanthropic farmers that may not match industry or economic reality. Because of this family farm romance, it is important to sort out today’s “real” from “pseudo-issues.” Is it economically possible to match the public image? Or how can one come closer to it? A contrasting image of agriculture is of a big impersonal corporate business that ruins the land. People have become separated from the land and the realities.

There is a perception that animal manure is not a resource. Manure is a valuable resource when used properly. The challenge is using it for optimal profit, while minimizing its impact on the environment—odor, greenhouse gases, water pollution, antibiotic, hormone, and pathogen release. Fortunately, there are many options to improve manure handling and use.

Possible actions:
- Educate the public (particularly children), environmentalists, and regulators about the realities of farming, notably about best practices, constraints on farmers and the impacts of policies and regulations.
- Encourage producers to become more involved in the educational process in schools at every level, develop better public relations skills, and implement effective good-neighbor programs.
- Perform outreach—bed and breakfast on a farm; agri-tourism; set up eco-tourism on ranches; joint meetings of agricultural and environmental groups; workshops/field trips for government officials; Chamber symposia; awards for stewardship; and create educational materials.
- Supply knowledgeable/reliable government contacts and trained technical staff to provide advice and assistance.
- Identify public preferences regarding farm landscapes to help farmers know what bothers their neighbors so that they can try and fix problems.
- Develop an increasing awareness of the roles of all contributors to pollution;
- Reach a middle ground in meeting the goals of economical production agriculture and dealing with environmental issues/concerns;
- Obtain a commitment of integrators and processors to help overcome environmental issues, and
- Have the animal production and fertilizer industries play a leadership role (e.g., through farm organizations, commodity groups etc).

A3. Political

There is a declining base of political support for farming. The problem is compounded by friction between county, state, and Federal governments. Regulations and policies in the U.S. are driving some farmers out of business, and the farm animal industry is gradually moving abroad, where operating standards can be lower or not enforced.

In European the absence of regulation in the past has been replaced by a trend to more detailed accounting and registration systems, largely based on groundwater nitrate and soil phosphorus considerations. Government programs regulate and provide financial reimbursement to livestock farmers.

Possible actions:
- Ensure that environmental solutions are driven by an emphasis on science not politics; and
- Place trade restrictions on countries that produce meat or crops under substandard environmental conditions; note that for this action there are the issues of how to establishment that conditions are substandard and how to enforce such a policy.

A4. Policies and Regulations

Problems occur when policies and regulations are impractical, not science-based, not flexible, and the handling of the economic impact has not been thought through and/or they are not equitable. Sometimes they are duplicative, uncoordinated and disincentive-based. Regulations vary from state to state. It is not always easy to know how to satisfy environmental regulations. To be effective, policies and regulations seeking to manage manure, and use of its nutrients and other beneficial properties, must have a clear connection to the economic and technological solutions available to the farming community. Failure to ensure economic solutions to problems and to provide opportunities to offset additional costs with additional benefits can lead to severe disruption of the farming communities and those who depend upon them. A careful balance of regulatory incentives and penalties, coupled to improved technologies and education, will be needed.

Possible actions:
- Coordinate air quality and odor standards and regulations with surface water, groundwater, and soil regulations for a comprehensive approach to addressing the overall environmental issues associated with contaminants or nutrients from animal waste and other sources (municipal and urban waste, and commercial fertilizers, transportation etc):
- This comprehensive approach should address all areas of environmental concern while protecting regulated entities that are in compliance.
- Develop a science base and a better system for preparing science-based regulations; including measurements and analysis, in advance of and following the setting of regulations;
- Environmental standards must be set by peer-reviewed, quantitative science;
- Regulations must be equitably and consistently applied yet designed for flexibility according to regional, watershed conditions, facility size, and production category (poultry, cattle, fish, etc.).
- Ensure that regulations are understood by all parties and enforceable, because they are more readily achievable if all parties are properly consulted, and listened to, in advance;
- Develop “Plain English” guides to regulations;
- Require a cost/benefit analysis prior to adoption of new federal and state environmental standards, and reach an understanding of how costs might be internalized and passed on to consumers;
- Regulatory enforcement must be combined with compliance attainment guidance via technical assistance, dissemination of Best Management Practices (BMP) and Best Available technology (BAT) information and sustained support;
- All laws and regulations should have a sunset provision;
- Establish performance standards and allow the producers to select the best management practices to meet these standards, which should be socially, economically, and environmentally acceptable and sustainable;
- Have a process for producers/regulators to develop alternatives and incentives, and take advantage of voluntary incentive-based approaches, and reward people who do a good job;
- Develop action plans for specific geographic areas, including all interested parties—form partnerships;
- Educate regulators and industry staff about the realities of the farming industry through on-farm education sessions;
- Compliance assistance: regulatory agents should also be of assistance to those expected to comply;
- Allocate more funds and personnel to enhance monitoring and assessment of environmental quality, particularly of aquatic systems; and,
- Regulations for using animal manure, bio-solids, and other organic nutrients, should carry no greater regulatory burden than those for commercial fertilizer;

A5. Economics

A primary issue is how a farm can stay in business and meet environmental regulations. This problem is compounded by the inequities in the cost of compliance in various regions of the U.S., that tend to drive livestock and poultry farming to the regions of lowest environmental standards—not a long term solution! Agriculture is becoming more risky as a new venture. Taxes and discriminatory programs are severely damaging to the small producer. Failure to ensure that economic, environmental and social goals are compatible could lead to a move of the industry abroad. This would reduce employment in the U.S. (millions employed in the farming industry), reduce exports, increase imports, imperil the food security and food safety for the U.S., and weaken the United States’ trading position. A reduction in U.S. food production is also not in the interest of a world whose population is projected to reach 9 to 12
billion by the end of the century. Other beneficial uses of manure should be pursued in addition to the manure use as a fertilizer. For example, the total dry weight of manure in the United States is about 300 million tons a year. It has an energy content about half that of coal. It is a sustainable resource whose use could reduce greenhouse gas emissions and improve U.S. energy security.

Possible actions:
- Have a realistic price for products to allow farmers to meet economic, environmental, and social goals—pass on the real costs to the public, develop a formula for cost distribution;
- Ensure that the cost of local, stricter regulations, is paid for locally;
- Obtain a commitment from integrators, processors, and the fertilizer industry to finding an integrated solution;
- Find more economical ways to handle manure while meeting environmental requirements, for both solid and liquid manure management systems;
- There is a lack of understanding that animals convert otherwise inedible material into food, clothing, and other products;
- Develop alternative uses and value-added products to offset the increased costs of compliance and increase profitability;
- EPA, DOE, and USDA should be encouraged to include animal wastes as feedstocks for bio-based products including bio-solids and bio-energy (reference Executive order of 8/12/99);
- Develop better national initiatives for manure systems;
- Maximize the amount of animal biomass used for energy conversion and provide incentives for electrical utilities to encourage and support generation from manure;
- Expand the use of green labeling and net-metering for electricity to include animal manure products;
- Do not pass all the economic benefits to the integrator. Save some for the farmer; and
- Explore possibility of environmental debits and credits so that farmers have more flexibility in achieving compliance.

A6. Mass Balance

In the old days, livestock and poultry ate the crops that were produced around them and their manure was used in the growing of new crops—a more or less closed cycle. Today, commercial fertilizers are used in growing feed crops for livestock and poultry. Most of the nutrients end up in manure and the manure is then distributed onto local fields. Generally, there is an inadequate local area to match the production of manure and there is a continual build up of nutrients in the soil and in the water sources. It is important to develop a balanced cropping and livestock system.

Because feed has a much higher value per ton than manure, it is often not economic to recycle the manure in a more or less closed cycle. Excess nutrients wash into the water system, adding to other pollutants, leading to a number of problems.
The problem is compounded by the large amounts of water associated with much of the manure, and the potential presence of pathogens and antibiotics in the manure. It is important to look at all the inputs, as well as sensitivity to local requirements in developing alternative technologies, specific nutrient sources, market opportunities, and management capabilities.

**Possible actions:**
- Have rules and regulations that provide a level playing field for all stakeholders—agricultural, fertilizer, and urban;
- Change state taxes that penalize the use of organic fertilizers by charging taxes by the ton not by the nutrient content;
- Standardization of level of limiting nutrient for land application;
- Limit by phosphate level not nitrogen level;
- Diet manipulation to control nutrient output (e.g., enzymes, amino acids, and equivalent diets);
- RD&D for economic nutrient concentration processes;
- Collection and storage/treatment of manure prior to application;
- Ship manure to a central location for treatment;
- Develop a system with the fertilizer industry to recycle nutrients;
- Develop additional markets for manure products;
- Target government funding to support the export of excess nutrients in the form of bio-based products (e.g., compost and energy); and
- Gradual relocation of farms to better match nutrient recycling.

### A7. Water

Contamination of the surface and ground water system is a serious problem for the livestock and poultry industry, because of issues related to nitrates, phosphates, ammonia, pathogens, endocrine disruptors, heavy metals, etc. Run-off of these substances adds to pollution from other sources leading to undrinkable water, fish kills, eutrophication etc. A continuing vital industry will have to do its part in dealing with such problems. Availability of good quality water is vital to the agricultural industry.

**Possible actions (also see nutrient management comments):**
- Identify, for each geographic region, all of the sources of water pollution that interfere with meeting established water quality goals;
- Develop total maximum daily loading for acceptable water quality levels for all uses on a watershed by watershed basis;
- Have a goal for all surface water to be potable, fishable, and swimmable;
- Track water based pollutants of all kinds and develop a national water quality data base;
- Develop an understanding of environmental risks associated with “good” and “bad” management of manure, and establish criteria for good management;
- Develop processes for disinfection that are specific to animal residuals based on local conditions, uses and available markets.
- Develop better, cost effective, measurement and analysis tools for use in monitoring and protecting water systems;
A8. Odors and Particulates

Odors and particulates emitted by livestock and poultry farms are a major source of public unhappiness with the farms. In addition, the odors, in sufficient concentration, are damaging to farm workers, the livestock and poultry, and to the farm’s infrastructure. The emissions are also a significant source of greenhouse gases. Present policies and regulations do not deal adequately with odor and particulate problems.

Possible actions:
- Coordinate air quality and odor standards and regulations with surface water, groundwater, and soil regulations for a comprehensive systems approach to addressing the overall environmental issues associated with animal waste;
- Generally, undertake basic research on approaches to reducing noxious odors. See the following bullets;
- Enclose manure—tanks, covered pits, and lagoons;
- Collect gases (e.g., methane collected and used to produce electricity and process heat, thereby offsetting costs or even generating revenues);
- Generally, develop advanced technologies to deal with the problems;
- Add control substance to manure to reduce ammonia emissions;
- Track air based pollutants of all kinds; and,
- Develop an emissions credit system to reward farmers who reduce emissions.

A9. Research, Development, and Demonstration

While a lot of progress has been made in supporting the needs of the livestock and poultry industry, there are many more possible profitable developments that could be realized. Further, more demonstrations are needed to qualify new opportunities for the farmer and the industry.

Possible actions:
- Develop a multi-disciplinary and systems approach to research;
- Develop the tools, measurements and analyses, to provide a better science base for decision making and to optimize farm operations;
- Develop user-friendly computer models for data analysis, and help in developing cost-effective, comprehensive nutrient management plans;
- Regional/watershed land use research should lead to the development of carrying capacity models and standards for limits of both point and non-point sources of nutrients from agricultural and other contributing operations;
- Study ecosystems/watersheds to determine true cause/effect relationships;
- Do research and prove (widespread agreement) that new developments will be workable and affordable in the real farm environment;
- Develop critical new technologies, such as cost-effective phosphate removal, separation, and recycling;
- Basic research is needed to determine the cause and effect of air contaminants on human health and the environment to subsequently establish odor and air standards for animal feeding operations;
- Research is needed to determine the scope and impact on human and animal health of pathogens, antibiotics and hormones associated with animal feeding operations.
- Continued RD&D is needed on improved integrated systems of waste management technologies including innovative nutrient recycling methods in conjunction with natural system solutions (buffer strips and wetlands);
- Continue research on animal science approaches to waste minimization (i.e. feed additives, genetic engineering of both feed and animals, natural hybrids, diversification of feed and livestock).
- Quantification of the total economic impact of improved waste management via a whole costs/benefits accounting analysis of the value of environmental protection and restoration due to reduction of the waste stream/nutrient loss.
- Arrange for cost-sharing developments and demonstrations, with public and industry support;
- Show the public and regulators how improved systems function;
- Communicate useful approaches and provide technical assistance;
- Reorganize and revitalize the extension programs of land grant colleges;
- Get better coordination of government (USDA, EPA, DOE, etc) and state agencies to enhance RD&D and make better use of public investments; and,
- Determine the effectiveness of bio-filters in the collection of nitrogen from composting.

**A10. Land Management**

It is important, nationally, to sustain production for livestock and poultry operations without significantly impacting the surrounding land, air, and water. Achieving a widely accepted balance between protection and economic sustainability is a challenge. There are decreasing opportunities for family farmers to earn a good living and sustain environmental quality. Policies for land management, in some states, have been growth oriented without due regard to equally important land sustainability values. This has lead to urban sprawl and a loss of good agricultural land.

Also, there is a lack of trust, understanding and cooperation among urban and agricultural interests, and government agencies. It is important to recognize the realities (requirements, management capabilities, and constraints) faced by the producers in meeting the demands of the public while maintaining a sustainable system. As a society, we have not developed an equitable, accountable, and sustainable policy for preserving, protecting, and using natural resources. The issue of farm animal manure is often not solvable at the level of the family farm. Why? Because the inputs to and outputs from the operation typically come from, and are
distributed to, a far wider area than the farm or cluster of farms in question. Also, myriad of government regulations impact the decision making.

Possible actions:
- With urbanization and cropland loss, and increased transport costs, a management team approach is required to address complex issues in watersheds and regions in general;
- Develop whole-farm permitting programs that integrate all federal, state, and local government regulations into incentive-based best management practices to achieve public good.
- A movement towards having the livestock and poultry operations nearer the feed production areas may well occur to ameliorate the problems of manure management; and,
- Improve the infrastructure to support new approaches to increasing farm profitability, while decreasing pollution.

A11. Grazing Lands

There are concerns about grazing having effects on water quality, and improper use can have deleterious effects. Nevertheless, a problem affecting grazing land use is that some of the public interest groups, and government officials don’t understand that well-managed grazing lands are an asset. Therefore it is important to ensure that grazing lands are properly managed, protecting water quality, and providing habitat for plants and animals, while providing a fair economic return to their owners.

There is the issue of regulations of the use of animal wastes on grazing lands but no regulations on the use of commercial fertilizers. Further, pastures are used as dumping grounds for outside generated waste. These inconsistencies must be eliminated.

A12. Existing Programs

National Strategy—The Unified National Strategy for Animal Feeding Operations (USEPA, USDA) is based on focusing on the greatest risks, establishing long-term sustainability, developing performance expectations, and coordinating federal, state, and local activities. “This strategy presents a comprehensive inter-agency approach to solving water pollution problems that are caused by AFOs. Centered, largely, around the goal of developing and implementing comprehensive nutrient management plans at all AFOs by 2009, it includes a variety of voluntary, incentive-based programs as well as regulatory components.”

State Regulatory Program—Maryland's comprehensive nutrient management program includes research, incentives for technology development, assistance with transportation costs, and mandatory controls on all nutrient inputs, based on both nitrogen and phosphorus. Key to the program's phased-in implementation will be the development of a phosphorus indexing method to be used on all sites to determine the degree of their environmental sensitivity with respect to various P sources (organic and inorganic).
Natural Resource Conservation Service Role—NRCS will provide technical guidance for Comprehensive Nutrient Management Plans (CNMPs), new and revised conservation practices at national and state levels, and staff training. Policies that determine how and to whom these services will be provided, priorities, and measures of success need to be developed. Policy regarding use of phosphorus indexing is also to be determined.

Non-regulatory strategies—The Brazos River (TX) Authority has begun a collaborative, holistic approach for water management that involves diverse stakeholders in planning, monitoring, documenting, and community-based decision-making. The result will be a proactive strategy for addressing water quality issues in a watershed context. Predictive modeling will be used to assist poultry integrators and other industries, conservation groups, state and federal regulatory agencies, and the Authority to implement a cooperative effort.

There are many other excellent federal and state programs including USDA-CSREES’s role through its Extension Systems, Experiment Stations, and Land-Grant Universities, AgStar (EPA, USDA, DOE), and the National Soil Phosphorus Project (USDA), FarmA*Syst (USDA, Universities, EPA), EQIP (USDA), Nonpoint Source Program (USEPA), National Estuary Program (USEPA), Clean Water State Revolving Fund (USEPA). Further, green labeling is used in a number of states for agricultural products.

Role of Conservation Districts—The NACD has provided assistance to landowners on planning and conservation measures on a watershed basis since the 1950’s. Their strategic alliances with the NRCS, EPA, TVA, USGS, Forest Service and many local organizations provide an opportunity for collaborative problem-solving efforts at the local level. Conservation Districts should continue to be a major player in the watershed approach to dealing with non-point source pollution.
Appendix B—Alliance for Environmental Stewardship: A Comprehensive Approach—Workshop Advisory Committee

Deborah Atwood, National Pork Producers
David Brubaker, Johns Hopkins, School of Public Health, Center for a Livable Future
F.D. Causey, Duke E&ES
Rika Cecil, Washington State University Cooperative Extension, King County
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Ted Funk, University of Illinois
Larry Goff, U.S. Poultry Water Quality Consortium
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Robert Harris, DOE-EE&RE
Richard Hegg, USDA-CSREES
Steven Hildebrand, Oak Ridge National Laboratory
Joseph Hoagland, Tennessee Valley Authority
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Members of the National Research and Extension Committee:

Charles Abdalla, Penn. State University
Asmare Atalay, Virginia State University
Ginny Claycomb and Bill Hargrave, Kansas State University
Bill Harris, Texas A&M University
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Deanne Meyer, University of California – Davis
James C. Wade, University of Maryland
Michael Westendorf, Rutgers University
Appendix C—Acronyms

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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFO</td>
<td>Animal Feeding Operation</td>
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<tr>
<td>BAT</td>
<td>Best Available Technology</td>
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<td>BMP</td>
<td>Best Management Practices</td>
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<tr>
<td>CAA</td>
<td>Clean Air Act</td>
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<tr>
<td>CAFO</td>
<td>Concentrated Animal Feeding Operation</td>
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<td>CNMP</td>
<td>Comprehensive Nutrient Management Plan</td>
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<td>Coastal Zone Act Reauthorization Amendments</td>
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<td>DAF</td>
<td>Dissolved Air Flotation</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>EE&amp;RE</td>
<td>Energy Efficiency &amp; Renewable Energies</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>EPRI</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>EQIP</td>
<td>Environmental Quality Incentives Program</td>
</tr>
<tr>
<td>ESCOs</td>
<td>Energy Services Companies</td>
</tr>
<tr>
<td>FEMP</td>
<td>Federal Energy Management Program</td>
</tr>
<tr>
<td>H&amp;HS</td>
<td>Health &amp; Human Services</td>
</tr>
<tr>
<td>IRC</td>
<td>Internal Revenue Code</td>
</tr>
<tr>
<td>JIEE</td>
<td>Joint Institute for Energy and Environment</td>
</tr>
<tr>
<td>NACD</td>
<td>National Association of Conservation Districts</td>
</tr>
<tr>
<td>NETL</td>
<td>National Energy Technology Laboratory</td>
</tr>
<tr>
<td>NOx</td>
<td>Nitrogen Oxides</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
</tr>
<tr>
<td>NYSERDA</td>
<td>New York State Energy Research &amp; Development Agency</td>
</tr>
<tr>
<td>RD&amp;D</td>
<td>Research, Development &amp; Demonstration</td>
</tr>
<tr>
<td>SAMAB</td>
<td>Southern Appalachian Man and the Biosphere</td>
</tr>
<tr>
<td>SBIR</td>
<td>Small Business Innovation Research</td>
</tr>
<tr>
<td>SOx</td>
<td>Sulfur Oxides</td>
</tr>
<tr>
<td>TVA</td>
<td>Tennessee Valley Authority</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>ARS</td>
<td>Agriculture Research Service</td>
</tr>
<tr>
<td>CSREES</td>
<td>Cooperative State Research Education and Extension Service</td>
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<tr>
<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
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<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile Organic Compounds</td>
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</table>