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EXAMINATION OF THE POTENTIAL HUMAN HEALTH, WATER QUALITY AND OTHER IMPACTS OF THE CONFINED ANIMAL FEEDING OPERATION INDUSTRY

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

SEPTEMBER 6, 2007

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED TENTH CONGRESS
FIRST SESSION

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[1]Note: During the 110th Congress, Senator Craig Thomas, of Wyoming, passed away on June 4, 2007. Senator John Barrasso, of Wyoming, joined the committee on July 10, 2007.

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EXAMINATION OF THE POTENTIAL HUMAN HEALTH, WATER QUALITY AND OTHER IMPACTS OF THE CONFINED ANIMAL FEEDING OPERATION INDUSTRY

Thursday, September 6, 2007

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The full committee met, pursuant to notice, at 10 a.m. in room 406, Senate Dirksen Building, Hon. Barbara Boxer (chairman of the full committee) presiding.

Present: Senators Boxer, Inhofe, Carper, Lautenberg, Bond and Barrasso.

OPENING STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. We are here today to hold a hearing, which I call to order, on a critically important public health issue, concentrated animal feeding operations, or CAFOs. CAFOs are industrialized animal production facilities including some that can hold more than one million animals. I want to ensure that there is a clear picture of the significant environmental and health issues that stem from these facilities.

There is currently a proposal that would exempt CAFOs from important environmental and public health safeguards, in particular from the public reporting or right to know provisions of the Superfund Law. The proposal also would eliminate provisions that ensure polluters pay to clean up their mess.

People deserve to have a clear understanding of the environmental threats in their communities, so they can make informed decisions to protect themselves and their families.

These environmental protection laws also ensure that where there has been damage caused by these facilities and there have been numerous instances of air and water pollution, contamination of wells and other water supplies, the parties responsible can be held accountable and pay to clean up the mess they made. Proposals to weaken accountability for CAFOs pollution undermine public health and the public's right to know about pollution, and I believe it would be bad news for the American taxpayer.

Proposals to roll back environmental protections on CAFOs have sometimes been portrayed as a non-controversial issue, but in fact there have been serious consequences, including deaths, connected with CAFOs across the Country. Just this year, five people—four members of a family and a farmhand—died in Rockingham County, VA, when the father was overcome by hydrogen sulfide gas from their dairy farm manure pit that he was trying to repair. Others died from breathing the gas while trying to save him.

The waste can increase phosphorus levels in water, causing algal blooms that can foul drinking water supplies, increase treatment costs and cause massive fish kills. CAFOs can create significant air pollution including foul odors, ammonia, volatile organic compounds and hydrogen sulfide. CAFOs' air pollution can exceed the amounts emitted by industrial facilities.

Let me repeat that: CAFOs' air pollution can exceed the amounts emitted by industrial facilities.

When the proponents of these proposals come to me, they all say, well, you know, farms are different than industry.

Well, in a lot of ways they are, but in this way, in some cases, it could be worse in terms of the pollution.

I believe this hearing will contribute to the public's clear understanding of the threats to environmental and health associated with these facilities. Well managed agricultural operations can avoid serious environmental and public health consequences. Rollbacks on environmental reporting and polluter pays requirements will greatly increase the risks that these facilities can pose to local communities.

That concludes my statement.

[The prepared statement of Senator Boxer follows:]

STATEMENT OF HON. BARABARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

We are here today to hold a hearing on a critically important public health issue—Concentrated Animal Feeding Operations, or "CAFOs".

CAFOs are industrialized animal production facilities, including some that can hold more than 1 million animals.

I want to ensure that there is a clear picture of the significant environmental and health issues that stem from these facilities.

There is currently a proposal that would exempt CAFOs from important environmental and public health safeguards—in particular from the public reporting or "right to know" provisions of the Superfund law. The proposal also would eliminate provisions that ensure polluters pay to clean up up their mess.

People deserve to have a clear understanding of the environmental threats in their communities so they can make informed decisions to protect themselves and their families.

These environmental protection laws also ensure that where there has been damage caused by these facilities—and there have been numerous instances of air and water pollution and contamination of wells and other water supplies—the parties responsible can be held accountable and pay to clean up their messes.

Proposals to weaken accountability for CAFO pollution undermine public health and the public's right to know about pollution, and would be bad news for the American taxpayer.

Proposals to roll back environmental protections on CAFOs have sometimes been portrayed as a non-controversial issue, but in fact there have been serious consequences—including deaths— connected with CAFOs across the country.

Just this year, five people—four members of a family and a farm hand—died in Rockingham County, Virginia when the father was overcome by hydrogen sulfide gas from their dairy farm manure pit that he was trying to repair, and others died from breathing the gas while trying to save him.

The waste can increase phosphorus levels in water, causing algae blooms that can foul drinking water supplies, increase treatment costs, and cause massive fish kills.

CAFOs can create significant air pollution, including foul odors, ammonia, volatile organic compounds and hydrogen sulfide. CAFOs' air pollution can exceed the amounts emitted by industrial facilities.

I believe this hearing will contribute to the public's clear understanding of the threats to environmental and health associated with these facilities.

Well managed agricultural operations can avoid serious environmental and public health consequences. Rollbacks on environmental reporting and "polluter-pays" requirements will greatly increase the risk that these facilities can pose to local communities.

Senator BOXER. I want to put in the record, and I ask unanimous consent to do it, the list of State and local officials, public health, farm and environmental groups who oppose weakening health protections and the polluter pays principle. I may make reference to this later.

[The referenced material follows:]

State and Local Officials, Public Health, Farm and Environmental Groups Oppose Weakening Health Protections & the Polluter Pays Principle

- U.S Conference of Mayors
- National Assoc. of Counties
- National Assoc. of City and County Health Officials
- American Public Health Association
- National League of Cities
- American Water Works Assoc.
- Iowa Department of Natural Resources
- City of Waco, Texas
- City of Tulsa, Oklahoma
- Institute for Agriculture & Trade Policy
- National Environmental Trust
- Sustainable Agriculture Coalition
- Food and Water Watch
- Attorneys General from eight states
- National Assoc. of Clean Air Agencies
- American Metropolitan Water Agencies
- Natural Resources Defense Council
- Sierra Club
- Union of Concerned Scientists
- Environmental Integrity Project
- Earthjustice
- The Humane Society of the U.S.
- U.S. PIRG
- Environmental Working Group
- Western Org. of Resource Councils
- Waterkeeper Alliance
- Izaak Walton League of America

Senator BOXER. We are very pleased to have with us a couple of great panels. It is not that we want to rush you. It is that we want to get to all of you. So I am going to be tough on the 5-minute rule. I am going to say as soon as we have 30 seconds to go, I am going to say finish up, and we are going to move on.

When Senator Inhofe, I will turn to him for his opening statement.

We will start off with panel one, and we are going to go this way across. We will start Robert Hirsch, Associate Director for Water, U.S. Geological Survey.

Welcome, sir, and you are on.

STATEMENT OF ROBERT HIRSCH, ASSOCIATE DIRECTOR FOR WATER, U.S. GEOLOGICAL SURVEY

Mr. HIRSCH. Thank you.

Madam Chairman and Committee members, I appreciate the opportunity to appear before the Committee on Environment and Public Works to testify on U.S. Geological Survey studies of water quality issues related to CAFOs.

I am Dr. Robert M. Hirsch, Associate Director for Water, the U.S. Geological Survey.

My written statement contains a number of specific findings from USGS studies and contains a reference list of USGS publications from which the testimony was developed. My oral remarks will briefly summarize that material, and I request that my full statement be entered into the record.

Senator BOXER. Without objection.

Mr. HIRSCH. The mission of the USGS is to assess the quantity and quality of the Earth's natural resources and to provide scientific information to help resource managers and policymakers at the Federal, State and local levels to make sound decisions. Assessment of water quality conditions and research on the fate and transport of pollutants and water are important parts of the USGS mission.

We work closely with EPA, USDA, the Fish and Wildlife Service and public health agencies like the Centers for Disease Control and Prevention to ensure that the results of our research and monitoring are useful and widely available.

The quality of our Nation's water is affected by many things including geologic factors such as naturally occurring metals and atmospheric deposition of various substances. In addition, activities on the landscape such as urban and suburban development, agriculture, mining and energy production all affect water quality.

CAFOs are a relatively new and rapidly changing factor which the USGS is studying as part of its mission to understand the Nation's water quality and what influences it. USGS studies over the past 10 years have shown that CAFO impacts can include a wide variety of contaminants in many different environmental settings.

The USGS and other organizations have investigated impacts from CAFOs that include the following: nutrients that cause hypoxia or harmful algal blooms or could contaminate drinking water sources, trace elements such as arsenic and copper that can affect fish and aquatic plants, pathogens such as bacteria, viruses and parasites, antibiotics that could foster the development of antibiotic-resistant pathogens and hormones that could influence fish reproductive capability.

USGS research has focused on five major areas of investigation that are designed to track contaminants from their sources through the environment and to animal and human receptors. These research topics are development of methods for identifying and quantifying veterinary medicines, naturally occurring hormones, pathogens, surfactants and other compounds which are not typically monitored in the environment but which are likely to be associated with a variety of sources including non-concentrated animal production, CAFOs and sewage treatment plants.

The second area of study is quantifying relative contributions and types of environmental contaminants originating in CAFO waste.

Third, documenting and understanding the direct and indirect pathways of these contaminants in the environment.

Fourth, developing source fingerprinting or source tracking techniques that use genetic, chemical and microbial approaches to identify sources of environmental contaminants. These fingerprinting techniques may have the potential to enable water quality scientists to discriminate between contaminants coming from CAFOs and those coming from sewage treatment plants or other sources.

And, finally, investigating potential individual and community level ecological health issues that have been hypothesized to arise from CAFO contamination. These issues include eutrophication and oxygen depletion, diseases from pathogens, antibiotic resistance and endocrine disruption.

Through our research and monitoring, the USGS has found CAFOs to be a source of nutrients such as nitrogen and phosphorus and ammonia, pharmaceuticals including both synthetic and naturally occurring compounds and metals like arsenic and copper in nearby waters and lands receiving wastes.

Ongoing research at the USGS is focused on comparisons of the importance of CAFOs sources to other common sources. Accurate identification of sources and movement of waste contaminants requires more research on degradation and metabolic products from the many compounds used in animal agriculture.

The USGS will continue to work closely with EPA, the USDA, the Fish and Wildlife Service and public health agencies as we move forward on these issues.

I appreciate the opportunity to testify on the results of USGS' assessments and research on CAFOs, and I am happy to respond to questions from the Committee.

[The prepared statement of Mr. Hirsch follows:]

STATEMENT OF ROBERT HIRSCH, ASSOCIATE DIRECTOR FOR WATER, U.S. GEOLOGICAL SURVEY

Madam Chairman and Committee members, I appreciate the opportunity to appear before the Committee on Environment and Public Works to testify on the findings of U.S. Geological Survey (USGS) studies of water-quality issues related to Concentrated Animal Feeding Operations, commonly referred to as CAFOs.

As you may know, the mission of the USGS is to assess the quantity and the quality of the earth's resources and to provide information to assist resource managers and policymakers at the Federal, State, and local levels in making sound decisions. Assessment of water-quality conditions and research on the fate and transport of pollutants in water are important parts of the overall USGS mission.

USGS studies over the past 10 years have shown that CAFO impacts can include a wide variety of contaminants in many different environmental settings. The USGS and other organizations have investigated impacts from CAFOs that include the following: nutrients and their proximity to receiving waters that could cause hypoxia, harmful algal blooms, or contaminate drinking water sources; trace elements such as arsenic and copper that can contaminate surface waters and affect fish and aquatic plants; pathogens such as bacteria, viruses, and parasites; antibiotics that could foster the development of antibiotic-resistant pathogens; pesticides and hormones that can influence changes in fish reproductive capability; and solids from feed and feathers that could limit growth of desirable aquatic plants.

USGS research has centered on five major areas of investigation which are designed to track contaminants from their sources, through the environment, and to animal and human receptors:

1. analytical method development
2. occurrence and relative source contributions of specific chemical and microbial contaminants and their mixtures
3. pathways into and through the environment
4. source fingerprinting, and
5. ecological effects. These areas of research are designed to provide scientific insights into potential public and ecological health impacts as well as provide management and policy decisionmakers with CAFO related information.

ANALYTICAL METHOD DEVELOPMENT

The first step in assessing potential environmental contamination from CAFOs is to anticipate and identify chemicals and microbes that are likely to be associated with CAFO wastes and effluents. USGS scientists continually develop new methods for identifying and quantifying veterinary medicines, naturally occurring hormones, pathogens, surfactants, and other compounds which are not typically monitored in environmental settings but which are likely to be associated with a variety of sources including, non-confined animal production, CAFOs, and sewage treatment plants. Indeed much of our research related to CAFO impacts on the environment thus far has focused on analytical method development for a range of these potential contaminants in various environmental matrices including water, sediment, and animal tissue.

OCCURRENCE AND RELATIVE SOURCE CONTRIBUTIONS

Because environmental contaminants have many sources, the USGS is quantifying relative contributions and types of environmental contaminants originating in CAFO wastes. The intent is to understand environmental contaminants that are specific to CAFO operations.

CAFOs can be sources of nutrient introduction to the environment. Around the Nation, the USGS finds that relative to other sources (atmospheric sources, synthetic fertilizers, or point source nitrogen), manures were shown to be the single largest source of nitrogen for some rivers, such as the Susquehanna (PA), Altamaha (GA), Apalachicola (FL), White (AR), San Joaquin (CA), and the Fox (WI). Manures are the second largest source of nitrogen for the Potomac (VA, MD), Trinity (TX), Rio Grande (NM), Snake (ID), Platte (NE), and Willamette (OR). In the Neuse River Basin of North Carolina, we have found that nitrogen concentrations in groundwaters near or under areas treated with liquid swine waste tend to be higher than areas treated with synthetic fertilizers. After 4 years of application, nitrogen concentrations from swine waste increased by 3.5 times in shallow groundwater compared to concentrations prior to application, and median nitrate concentrations were about double from swine spray applications compared to commercial fertilizer. In Oklahoma, shallow monitoring wells were tested around CAFO hog operations from the central part of the State to the northwest, and these monitoring wells indicated considerably higher nitrate concentrations than for monitoring wells away from CAFO installations. For 79 wells sampled in 2001, median nitrate concentrations in wells affected by animal operations were near 30 mg/L versus about 15 mg/L for wells mostly affected by fertilizer applications. These studies indicate a substantial influence from CAFO operations on nitrogen concentration in the underlying aquifer, and although the wells tested were not used for drinking water, the U.S. Environmental Protection Agency drinking water nitrate standard of 10 mg/L was exceeded.

A study conducted in the Stillwater Basin in Ohio examined runoff from agricultural fields for a variety of contaminants. The study showed that veterinary antibiotics, particularly lincomycin (detected in 23 percent of samples), were present more frequently in streams draining watersheds with the highest animal density. Antibiotics introduced to the environment from the many CAFO type operations are of interest because of their potential for causing antibiotic-resistant bacteria to proliferate. In a reconnaissance water sampling of fish hatcheries in 7 States from 2001 to 2003, the USGS found aquaculture-approved antibiotics at low concentrations in about 15—30 percent of samples from hatchery water.

The USGS conducted a study near a National Wildlife Refuge in Nebraska to determine the impacts of swine operations on fecal bacteria occurrence. For the area near hog operations in Nebraska, we found that the CAFO was a potential source of zoonotic bacterial pathogens like salmonella. Wetlands created from swine wastewater effluent had 5–50 fold greater concentrations of phosphorus, ammonia, and total nitrogen, and 2–3 fold greater salinity compared to control sites. Cyanobacteria were abundant in the created wetlands and microcystin toxins were also detected in three of six wetlands sampled water samples.

CAFO operations may also be sources of metals like copper and arsenic. Often these metals are used as feed amendments to enhance animal growth. Organic arsenic feed additives are used in poultry production for increasing weight gain, improving feed efficiency and pigmentation, and controlling bacterial and parasitic disease. The USGS has done reconnaissance for arsenic on the Delmarva Peninsula in areas dominated by poultry production. From our examination of storm water, soil water and shallow groundwater, it is evident that some arsenic from poultry operations is released to the environment because concentrations in fresh poultry litter were about 10 times the concentrations found in soil of the area. Concentrations in most samples in the Delmarva were generally below the drinking water standard of 10L (parts per billion).

USGS water-quality research continues to show that contaminants in water resources seldom occur alone and more commonly occur in mixtures with other contaminants, including combinations of naturally occurring or man-made inorganic, organic, or microbial contaminant groups. These mixtures sometimes originate from similar sources but often come from varied sources contributing contaminants to our watersheds and aquifers

PATHWAYS INTO AND THROUGH THE ENVIRONMENT

CAFO wastes can enter the environment directly though leaching under lagoons, ditching, or other direct hydraulic connections or they can enter indirectly when solid and liquid wastes are removed from CAFOs and applied to land elsewhere as nutrient and soil amendments. Once in the environment, various properties of chemical and microbial contaminants as well as interactions with ambient conditions will determine their movement and behavior. For example, some contaminants have a natural affinity to attach to soils or organic material and therefore tend to be sequestered close to the sources of contamination while others readily dissolve in water and may move long distances from the introduction location. The type of soil, amount of organic material, and indigenous bacterial populations it contains may facilitate or retard the movement of various contaminants.

In one study around hog operations in Iowa where tetracycline was used, we did not find the antibiotic in the groundwater or even the lagoon berm, probably because tetracycline is known to sorb to solids and the area soil is rich in organic matter. In contrast near a hog operation in North Carolina where both tetracycline and sulfamethazine are used, tetracycline was not found in monitoring wells near the lagoons, but the sulfamethazine was found. Sulfamethazine is known to be much more mobile in water than tetracycline.

Poultry litter is applied to croplands in the North Carolina coastal plain as a nutrient source, as it is in many areas across the Nation, and the application increased shallow ground-water concentrations of nitrogen more than synthetic fertilizer applications in the vicinity. This is an important finding because synthetic sources of nitrogen are typically applied in readily available forms to plants as opposed to manures, which require additional natural processing after application and likely remain in the soils for longer periods of time. Therefore the time between animal fertilizer application and when their nutrients become available to plants dictates the volume needed as well as timing of application, and understanding these factors will be crucial to finding effective management solutions. In contrast to the North Carolina study, however, USGS research in southwestern Missouri, where poultry operations are also concentrated, did not find that nitrogen concentrations increased in shallow groundwater after several years of poultry litter application was used as a soil amendment. These differences likely represent soil and geohydrologic property differences between the two areas studied and the time period over which the studies were conducted. The results suggest that it is difficult to make broad generalized statements about CAFO impacts to the environment from these studies of limited geographic and temporal scope.

Movement of contaminants in CAFO waste also depends on farm operations and local environmental conditions, and may reflect the hydrologic or precipitation conditions at time of sampling. In addition, hormones and other chemicals are excreted in a changed or transformed form after being metabolized by animals and therefore have different toxicological, chemical, and physiological characteristics than before they are metabolized. Waters draining land where animals have been raised on pasture and not subject to CAFO finishing will likely have unique chemical signatures. These differences in water chemistries must be understood in context with the individual species of animals raised in CAFOs as compared with their pastured counterparts in order to understand contaminant issues unique to CAFO management procedures. All these factors along with the many sources of waste products from human and animal activity contribute to wide variation in environmental conditions at or near CAFO operations.

SOURCE FINGERPRINTING

In addition to development of laboratory analytical methods for specific contaminants, the USGS is focusing on development of "source-fingerprinting" or "source-tracking" techniques to identify various waste, and other, sources of environmental contaminants. These efforts include genetic as well as chemical and microbial approaches but all share the common objective of identifying one or a few chemicals/microbes which, when detected in environmental waters, can be unambiguously traced back to a unique contaminant source.

As mentioned before, there are many varied sources of nitrogen to the environment and therefore we believe it is important to determine the different sources of nitrogen in surface and groundwaters. The USGS is developing tools to identify sources of nitrogen from CAFOs using nitrogen isotopes and elements such as calcium, magnesium, sodium and potassium. In test wells located in fields sprayed with swine waste, concentrations increased after spraying by 2 to 4 times for many elements and an isotope of nitrogen (nitrogen–15), thereby indicating that the source of contamination was the swine waste.

Because CAFO areas can be an important source of bacteria and other pathogens, and the antibiotics from these areas can lead to antibiotic resistant bacteria, the USGS has been developing microbial source tracking methods to determine pathogen contamination of environmental waters associated with livestock sources. The approach is to distinguish the origins of gut microbes based on source-specific characteristics such as individual species that are host specific, like bacteroides found only in humans and therefore indicative of human waste sources, or bacteria populations resistant to antibiotics commonly used by humans versus other animals, or looking for genetic markers that indicate specific host-microbe interactions. While advances in these methods have been made in recent years, microbes are most often found in complex mixtures of waters from many waste sources originating from animals exposed to various food and other sources of chemicals and microbes. These, and other complexities, produce ambiguous results even within organism specific identification procedures.

In one study on biosolids applications in agricultural fields in Colorado, molybdenum and tungsten, and to a lesser degree antimony, cadmium, cobalt, copper, mercury, nickel, phosphorus, and selenium, were determined the most likely inorganic indicators of chemical migration from biosolid applications on land to groundwater or surface water. Other approaches have included indicators that occur infrequently in nature but are associated with specific uses and waste sources. While these fingerprinting techniques are not yet fully developed, they will soon be used alone or in conjunction with each other to enable the unambiguous distinction between contaminants coming from CAFOs and the many other potential sources of specific contaminants. This capability will be crucial for management and policy decisions unique to CAFO sources of environmental contamination.

ECOLOGICAL EFFECTS

Because most USGS research thus far has focused on methods development and occurrence activities we are still in the beginnings of investigating potential ecological health effects of CAFOs. USGS research is focused on individual as well as community-level ecological health issues such as eutrophication/hypoxia of nearby waters, diseases from pathogens, antibiotic resistance, and endocrine disruption.

Preliminary results have shown that fecal indicator bacteria counts in surface waters downstream of hog operations in Nebraska have exceeded Federal concentration standards for contact recreation, and the majority of bacterial isolates tested were resistant to at least one antibiotic, usually tetracycline. Initial results from the study in Nebraska near a National Wildlife Refuge indicate that impacts to created wetlands from nearby hog operations could pose a threat to waterfowl health due to pathogen exposure. In Oklahoma near cattle and hog operations, the findings were similar and although bacteria concentrations in Oklahoma were generally lower, they have exceeded Federal standards for contact recreation. In addition, resistance to antibiotics used in animal agriculture was common among fecal indicator organisms found in the Oklahoma study, especially gram positives, which includes many well-known genera such as Bacillus, Listeria, Staphylococcus, Streptococcus, Enterococcus, and Clostridium.

Information from studies in the literature and preliminary studies by USGS have guided us to focus future CAFO research on the spread of antibiotic resistance and the effects of hormonally active chemicals.

SUMMARY

The USGS has found CAFOs to be a source of nutrient, pharmaceutical, and metal contaminants in nearby waters and lands receiving wastes. Additional research is needed to determine the relative source contributions and environmental behavior of contaminants originating from a range of animal and land-use operations to make scientifically credible management and policy decisions specific to

CAFOs. Identification of sources and movement of waste contaminants requires more research on degradation and metabolic products from the many compounds used in animal agriculture, especially pharmaceuticals in various feed mixtures, therapies, and environmental settings. Some potential ecological effects have been hypothesized and are currently under investigation, including the role of CAFOs in eutrophication of receiving waters, wildlife exposure to pathogens and endocrine disruptors, and development of antibiotic resistance.

I appreciate the opportunity to testify on the results of USGS assessments and research on CAFOs. I am happy to respond to any questions from the Committee.

Senator BOXER. Thank you so very much.

Next, we will hear from Benjamin Grumbles, Assistant Administrator for Water, U.S. Environmental Protection Agency.

Welcome, sir.

STATEMENT OF BENJAMIN H. GRUMBLES, ASSISTANT ADMINISTRATOR FOR WATER, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. GRUMBLES. Thank you, Madam Chairman, and thank you, members of the Committee. I appreciate the honor to appear before the Committee to discuss this matter, which is a very important one, and represent EPA. It is an honor to be here.

EPA is working to accelerate the pace of environmental protection while maintaining our Country's economic and agricultural competitiveness.

I just want to say at the outset, Madam Chairman, that we recognize there are risks. There are substantial and significant risks from improper management of manure, from CAFOs in various respects, and the Agency is taking many actions with many partners on many fronts to advance the ball.

The first thing I would like to do is to say that over the years, EPA and USDA have recognized, both in this Administration and the previous administration, the importance of advancing efforts on nutrient management at CAFOs throughout the Country. CAFOs, as Bob Hirsch indicated, are changing. There is definitely a trend toward larger and more concentrated and intensive production efforts.

We also have concerns about the carrying capacity of certain watersheds, and so our approach, our strategy has been and will continue to be to use both the regulatory and statutory tools we have but most importantly to truly advance cooperative conservation and the voluntary programs and tools that are out there.

One of the items that I think is a national model is the California Dairy Quality Assurance Program. This is something that EPA is pleased to be a supporter of. That example as well as examples in the Chesapeake Bay, throughout the Country, demonstrate that voluntary efforts, education, producer education about nutrient management and what requirements exist under Federal environmental laws will lead us toward greater progress.

The next thing I would like to do is highlight some very important programs we have at EPA that we are stepping up the pace on. One is under the Clean Water Act, and that is the CAFO Rule. In February 2003, Madam Chairman, the Agency issued a final rule on CAFOs which made substantial improvements over the rule from the 1970's.

It reduced the level of exemptions. It expanded the universe. It clarified that land application of manure was subject to Clean

Water Act regulatory requirements. It took several important steps.

We have been focusing for years on implementation of that rule, and we will continue to do so. It is important.

In the meantime, a very important development occurred, and that was a Federal court decision, the Waterkeepers decision in the Second Circuit. By and large, a large majority of that rule that this Administration issued was upheld. However, there were some key issues where we had to go back to the drawing board.

Madam Chairman, we are working on that as fast as we can, and we intend. The Administrator is looking to finalize that rule by the end of this year.

The next thing I would like to mention are some of the other efforts we are doing on the voluntary basis. We are working very closely with our State partners and the Departments of Agriculture throughout the Country to advance the knowledge and information on nutrient management, particularly under the Clean Water Act programs and authorities.

We have worked to help with a website for producer information and technology training. Our Agency has stepped up to the plate and held numerous training and workshop sessions, all about implementing that improved and revised February, 2003 rule.

The last thing I would focus on, Madam Chairman, is the importance of looking at other aspects and potential risks that may arise from concentrated animal feeding operations. One of those is through the air emissions as you mentioned.

The Agency, in 2005, released an air compliance agreement, and the goal there, Madam Chairman, is to increase knowledge about air emissions, to be able to have a good scientific understanding of how to characterize those risks and to further improve efforts under the Clean Air Act and to ensure that the air is clean and safe.

So we are very excited about that effort as well as working under other authorities that we have under other Federal programs, working in partnership with the agencies and with producers across the Country.

Madam Chairman, I am happy to answer questions that you or your colleagues may have.

Thank you.

[The prepared statement of Mr. Grumbles follows:]

STATEMENT OF BENJAMIN H. GRUBLES, ASSISTANT ADMINISTRATOR FOR WATER U.S. ENVIRONMENTAL PROTECTION AGENCY

I. INTRODUCTION

Madame Chairman and Members of the Committee, I am Benjamin H. Grumbles, Assistant Administrator for Water at the United States Environmental Protection Agency (EPA). Thank you for the opportunity to discuss EPA's programs and actions to protect water quality and public health from potential adverse effects of concentrated animal feeding operations (CAFOs). We are taking important actions, on many fronts with many partners, to accelerate the pace of environmental protection, while maintaining our country's economic and agricultural competitiveness.

II. HUMAN HEALTH, WATER QUALITY AND OTHER EFFECTS OF THE CONCENTRATED ANIMAL FEEDING OPERATION INDUSTRY

Nationally, there are an estimated 1.3 million farms with livestock. About 238,000 of these farms are considered animal feeding operations (AFOs) ? agriculture enterprises where animals are kept and raised in confinement. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures. AFOs annually produce more than 500 million tons of animal manure. If properly managed, these operations may minimize environmental impacts and provide valuable by-products; however, if improperly managed, the manure from these operations can pose substantial risks to the environment and public health.

Animal Feeding Operations (AFOs) are operations where animals are kept and raised in confined situations for at least 45 days/year and vegetation is not present in the confined area (to distinguish it from grazing operations). An operation must meet the definition of an AFO before it can be defined or designated as a concentrated animal feeding operation (CAFO). CAFOs are further defined as a large or medium CAFOs based primarily upon the number and type of animals confined at the operation. Additionally, an AFO that does not meet either of these definitions may be "designated" as a Small CAFO if it is determined to be a significant contributor of pollutants to waters of the US.

An ongoing trend toward fewer but larger farm operations, together with greater emphasis on intensive production methods, increases environmental and public health risks by concentrating more manure nutrients and other animal waste impacts within smaller geographic areas. In addition, many large operations do not have sufficient land to effectively use the manure they generate as fertilizer. Animal waste and wastewater can enter waterbodies from spills or breaks of waste storage structures (due to accidents or excessive rain), and over-application of manure to crop land.

Despite substantial improvements in the nation's water quality since the inception of the Clean Water Act, many of the Nation's assessed waters show impairments from a wide range of sources. Improper management of manure from CAFOs is among the many contributors to remaining water quality problems. EPA's 2002 National Assessment Data base summarizes State water quality reports (Section 305(b) reports) and categorizes the quality of the state's assessed waters as good, threatened, or impaired. For the 2002 reporting cycle, States assessed 19 percent of river and stream miles and 37 percent of lake, pond, and reservoir acres nationwide. Of the waters assessed by States, those States identified 45 percent of the assessed miles of rivers and streams as impaired; agriculture, hydromodification[1], and habitat alterations are the leading identified sources, in that order. States identified 47 percent of assessed acres of lakes, ponds, and reservoirs as impaired and identified agriculture, atmospheric deposition, land application/waste sites, and hydromodification as the leading sources.

Improperly managed manure has caused acute and chronic water quality problems and is a significant component of waterbody impairments. Manure and wastewater from CAFOs can contribute pollutants such as excessive amounts of nitrogen and phosphorus, organic matter, sediments, pathogens, heavy metals, hormones, and antibiotics to the environment. Excess nutrients (i.e., nitrogen and phosphorus) in water can result in or contribute to low levels of dissolved oxygen (anoxia), eutrophication, and toxic algal blooms.

These conditions may be harmful to human health and have been associated with algal blooms. Decomposing organic matter (i.e., animal waste) can reduce oxygen levels and cause fish kills. Pathogens discharged into waterways have also been linked to threats to human health. Pathogens in manure can also create a food safety concern if manure is applied directly to crops at inappropriate times. In addition, pathogens are responsible for some shellfish bed closures. Nitrogen in the form of nitrate can contaminate drinking water supplies drawn from groundwater.

III. EFFORTS TO REDUCE THE IMPACTS OF AFOS AND CAFOS

Congress passed the Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." (33 U.S.C. 1251(a)). Among its core provisions, the Act prohibits the discharge of pollutants from a point source to waters of the United States except as authorized by a National Pollutant Discharge Elimination System (NPDES) permit and it also requires EPA to establish

[1]Alteration of the hydrologic characteristics of a water body, such as channelization or water diversions

national technology-based effluent limitations guidelines and standards (ELGs) for different categories of sources. Section 502 of the Clean Water Act specifically defines the term "point source" (for the purposes of the NPDES program) to include CAFOs, but in addition exempts "agricultural stormwater discharges" from the definition of "point source."

EPA's regulatory program regarding animal agriculture focuses on the largest operations (or "CAFOs") which present the greatest potential risk to water quality.

EPA revised its NPDES regulations to control discharges from CAFOs in 2003. As a result of that rulemaking, EPA estimated at that time that close to 60 percent of all manure generated by AFOs would be regulated. In addition to these regulations, EPA has a strong voluntary program to reduce environmental impacts from animal agriculture, ranging from outreach programs to compliance assistance programs. An example of this is the Unified National Strategy for Animal Feeding Operations jointly developed by EPA and the United States Department of Agriculture (USEPA/USDA, March 1999) which specifies that the vast majority of operations that confine animals are and will continue to be managed through locally focused voluntary programs. EPA and USDA offer a comprehensive suite of voluntary programs (e.g. technical assistance, training, funding, and outreach) in addition to the regulatory programs to ensure that livestock operations, both regulated and non-regulated, properly manage their manure in order to protect the environment and public health.

The Strategy defines a national objective for all AFOs to develop comprehensive nutrient management plans to minimize impacts on water quality and public health from AFOs. The vast majority (estimated to be about 95 percent) of these plans will be developed under voluntary programs.

EPA's working relationship with USDA has strengthened our ability to protect the environment from animal agricultural runoff. Our two Agencies hold bi-monthly meetings to discuss all aspects of this issue. This, as well as our day-to-day collaborations with USDA, has promoted increased understanding of the industry, broadened our outreach efforts and increased our ability to provide onthe-ground technical assistance to the farmer.

The CAFO Rule

In February 2003, EPA made comprehensive improvements to NPDES regulations for CAFOs. These revisions updated regulations originally issued in the 1970's, and they expanded the number of CAFOs covered by NPDES requirements to an estimated 15,500 facilities and added requirements to manage the land application of manure from CAFOs. The Agency estimates that the revisions would reduce annual releases of phosphorus by 56 million lbs.; nitrogen by 110 million lbs; and sediment by over two billion lbs.

The rule also required all CAFOs with a potential to discharge to apply for NPDES permits and required them to comply with the technology and water quality-based limitations in the permit as defined by the permitting authority. It also required each permitted CAFO to develop and implement a site-specific nutrient management plan (NMP).

Stakeholders representing both industry and environmental groups filed lawsuits challenging various provisions in the regulations. The case was brought before the U.S. Court of Appeals for the Second Circuit. On February 28, 2005, the Second Circuit issued its decision in Waterkeeper Alliance et al. v EPA. While it upheld the majority of the regulatory provisions, the Court vacated the requirement that all CAFOs with a potential to discharge apply for NPDES permits, and held that only those CAFOs that actually discharge must obtain NPDES permits. The Court also held that the terms of the nutrient management plans (NMPs) are effluent limitations that must be made part of the permit and enforceable as required by sections 301 and 402 of the CWA and, as such, must be subject to public comment and must be reviewed and approved by the permitting authority. The court upheld EPA's definition of "point source" as including discharges from a CAFO's land application areas and its application of the "agricultural stormwater discharges" exemption to only those precipitation-related discharges that occur where the CAFO's land application practices ensure the appropriate agricultural use of the nutrients in the land-applied manure, litter and wastewater.

In June 2006, EPA proposed targeted revisions specifically to respond to the Court's ruling in the Waterkeeper case. EPA's proposed rule would require only those CAFOs that discharge or propose to discharge to apply for a permit. It would require CAFOs to submit their nutrient management plans to the permitting authority with their permit applications Permitting authorities would then be required to provide public notice and review of the plans, and include terms of the NMP as enforceable elements of the permit. It also clarifies that CAFOs land applying manure, litter or processed wastewater would not need NPDES permits if their only discharge is exempt agricultural stormwater.

EPA received 580 unique public comments on the proposed rule, which were considered in preparing a draft final rule. The draft final rule is currently undergoing a 90-day interagency review under Executive Order 12866, which began on August 13, 2007. We anticipate that the Administrator would sign the final rule by the end of the calendar year.

EPA believes our NPDES CAFO regulations are critical to restoring and protecting watersheds across the Nation and we are putting a priority on implementation. Since the 2003 regulations, EPA has instituted a quarterly reporting process for tracking the number of CAFOs and NPDES permits. This reporting shows that the number of CAFOs has grown to approximately 19,000 facilities, and that roughly 8,300—or 43 percent—of those CAFOs are covered by NPDES permits. The EPA is committed to finalizing the pending rulemaking process and to moving ahead in its work with States and agricultural partners to ensure continued increases in permits and NMPs for CAFOs.

In addition, outreach and training is a major component of our CAFO program. After the 2003 rule was finalized, EPA published a series of guidance documents—one particularly targeting the CAFO industry by providing plain language explanations of how to comply with the rule. We have also held training courses in all of our 10 Regions to ensure EPA and State CAFO permit authorities clearly understand how to implement this rule. Furthermore, we are principal participants in an annual meeting held for all State regulatory authorities on matters pertaining to CAFOs. The Association of State and InterState Water Pollution Control Agencies, or ASIWPCA, arranges this meeting and also holds monthly conference calls where EPA regularly participates, to keep State regulatory authorities up-to-date on CAFO regulatory issues.

CAFO Rule Extension

In July 2007, EPA finalized a rule extending certain compliance dates necessary to allow the Agency time to respond adequately to public comments on issues raised by the February 2005 Waterkeeper decision before those compliance dates take effect. It extended the date by which facilities newly defined as CAFOs under the 2003 rule must seek NPDES permit coverage to February 27, 2009. In addition, all permitted CAFOs now have until February 27, 2009, to develop and implement nutrient management plans.

The extensions provide time for States and the agricultural community to adjust to the new requirements once they are finalized. I also issued a memorandum urging regional offices and States to continue to implement their existing regulatory programs while the Agency's response to the Court decision is being finalized. Until NMPs and other aspects of the regulation can be implemented in accordance with the court ruling, State and existing Federal rules unaffected by the court ruling will continue to protect water quality.

IV. PARTNERSHIP AND COLLABORATION

EPA has forged strong working relationships with other organizations across the country to further promote environmental protection from CAFOs. One such organization is the National Association of State Departments of Agriculture (NASDA). State departments of agriculture are a source of expertise that EPA can use to provide both outreach and technical advice to farmers. As an example of this partnership, EPA awarded a grant under our Clean Water Act 304(b) program to NASDA to provide a website where farmers and the public at large can obtain information regarding State requirements and technical standards for manure management. It is called CNMPWatch.com.

Other partnership and collaborations include:

The California Dairy Quality Assurance Program: This partnership among industry, EPA, and State regulatory authorities offers a training course to farmers in addition to no-cost, onsite, independent evaluations of farmers' operations. The State has seen a decrease in the rate of surface water discharges from these operations as a result of the program, the cooperation of industry, and enforcement actions by the State and EPA.

USDA MOU: On May 9, 2007, the EPA and the U.S. Department of Agriculture (USDA) announced additional measures for coordination and cooperation among the two agencies in prioritizing and implementing nutrient reduction activities in the Chesapeake Bay watershed. Under the agreement, EPA and USDA are more closely coordinating actions, aligning resources, tools, and partners, and monitoring for results to accelerate clean water progress in the Bay watershed. Because crop and pasture use account for 25 percent of the Bay Watershed—which includes lands in Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia—the nutrient reduction activities include a significant focus on agricultural contributions from livestock operations.

Great Lakes: One of the key issue areas addressed in the Great Lakes Regional Collaboration's Strategy to Restore and Protect the Great Lakes is nonpoint source pollution. Agriculture is recognized as one of the sources of this pollution in the Great Lakes basin, and the Federal Great Lakes Interagency Task Force has several activities underway to help reduce the impacts of nonpoint source pollution on the Lakes. For example, USDA's Natural Resources Conservation Service (NRCS) is conducting rapid watershed assessments in eight watersheds in the western Lake Erie basin to collect natural resource data and apply critical conservation on the ground. USDA's Conservation Innovation Grants program is funding several efforts in the Great Lakes, including projects to reduce nutrient loadings and recycling waste streams from dairy farms. NRCS is also working with the Corps of Engineers as the Corps, through its Great Lakes Tributary Model program, develops watersheds models for State and local agencies to evaluate the effectiveness of conservation practices and prioritizes areas for attention.

Gulf of Mexico/Hypoxia: Reducing the large hypoxic zone in the Gulf of Mexico, which is largely created as a result of excessive nutrients coming from municipal facilities as well as agriculture, is a formidable challenge that requires focused attention by our Federal and State partners. EPA has taken a lead role reducing the affects of agricultural runoff on the hypoxic zone. In 1997, EPA led the formation of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, which I chair, and EPA continues to coordinate ongoing Task Force efforts. The goal of this Federal-State partnership is to identify innovative and non-regulatory approaches to reducing Gulf hypoxia while enhancing water quality and quality of life in the Mississippi River Basin (Basin) and the Gulf. We plan to issue a revision of the 2001 Action Plan in March 2008. Additionally, OW has sponsored four scientific symposia and requested EPA's Science Advisory Board to review the State of the science regarding: (1) the causes and extent of Gulf hypoxia, and (2) the scientific basis for different management options targeting hypoxia mitigation in the Mississippi River-Atchafalaya River Basin (MARB).

V. CAFO WATER ENFORCEMENT

With input from EPA Regions, States, Tribes, and the public, EPA's Office of Enforcement and Compliance Assurance (OECA) selects multi-year national compliance and enforcement priorities that focus on specific significant environmental problems and identified widespread noncompliance patterns. CAFOs have been an EPA Clean Water Act enforcement and compliance priority for several years, and EPA has proposed to maintain it as a priority through 2010. Our State partners have consistently identified agricultural operations as a leading source of water quality impairment throughout the Nation. Industry trends have resulted in larger-sized operations generating large volumes of manure. This, in combination with outdoor manure storage at some CAFOs has contributed to some unauthorized discharges into waters of the United States.

EPA's recent compliance monitoring and enforcement efforts have focused primarily on existing CAFOs that are discharging without an NPDES permit.

In fiscal year 5, EPA Regions conducted 174 Federal inspections and 118 joint inspections with States at CAFOs, and concluded 63 enforcement actions against CAFOs for Clean Water Act violations. In fiscal year 6, EPA Regions conducted 262 Federal inspections and 130 joint inspections with States at CAFOs, and concluded 56 enforcement actions against CAFOs for Clean Water Act violations.

VI. CAFO AIR COMPLIANCE AGREEMENT AND MONITORING STUDY

EPA concluded and the National Academy of Sciences confirmed that it did not have sufficient air emissions data for animal feeding operations (AFOs), which made it difficult to determine the compliance status of AFOs with regard to existing air emission requirements. In January, EPA published a Federal Register notice providing AFOs with the opportunity to participate in a voluntary consent agreement and monitoring study. As part of the agreement, each participant agreed to: 1. pay a penalty for potential past and ongoing CERCLA, EPCRA, and CAA violations; 2. direct the payment of money into an industry fund used to conduct a national air emissions study; and 3. make its farm available, if selected, for air emissions monitoring; 4. use the emission estimating methodologies developed from the monitoring study to determine its compliance status, and comply with any applicable CAA, CERCLA, or EPCRA requirements. The goals of this innovative enforcement agreement were to ensure compliance with Federal laws regarding air emissions, monitor and evaluate AFO air emissions, reduce air pollution, and promote a national consensus on methodologies for estimating air emissions."

VII. CONCLUSION

Thank you Madame Chairman and Members of the Committee for the opportunity to describe environmental and public health risks from CAFOs and the many actions EPA is taking with our State, local and agricultural partners. The implementation of the Unified National Strategy for Animal Feeding Operations and EPA's 2003 and 2007 CAFO rules is critical in our mission to restore and protect watersheds across the Nation. EPA is committed to working with our Regions, States and agriculture partners to ensure timely development of NMPs and submission of permit applications and proper nutrient management from all livestock operations.

I would be happy to respond to any questions you may have.

Senator BOXER. Thank you so much.

Just in perfect timing because I was about to call on the Attorney General from Oklahoma, our Ranking Member, Senator Inhofe has arrived, and I know he would like to make some comments. So you are recognized

Senator INHOFE. Very brief, and this is one of the rare times, Madam Chairman, that I am glad you are Chairman and not me to try to juggle all these votes that are coming up in front of us.

Senator BOXER. I know.

Senator INHOFE. First of all, it is a real honor for me to have two Oklahomans coming before us today, Madam Chairman.

Michael Dicks of the Oklahoma State University, I have to say how much I enjoyed. I guess you are back there some place.

Senator BOXER. He must be. There he is.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. Yes, there he is. I enjoyed the honor that I got at Oklahoma State University last Friday and all the contributions that you have made.

I have to say to my good friend, Drew Edmondson, that I have known for a long, long time. He is a Democrat. He is an outstanding public servant, and he comes from a long line.

I knew J. Howard Edmondson very well. I knew your dad and Ed Edmondson, well for a long, long time, and so I appreciate very much your being here.

The only thing that I would want to mention is that as we look forward to this, I happen to have been out in the Panhandle just about 4 days ago. As we look at the problem that is there, that we are addressing today—and I am glad we are addressing this—I just want to keep in mind, Madam Chairman, that we have a lot of our farmers in Oklahoma and throughout America that watch very carefully the decisions that we are making today and the discussion that is going on.

So I will look forward to asking questions at the appropriate time and look forward to the hearing.

I apologize for being late, but as you know we had our Armed Services hearing. They let me go first on that one.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Oklahoma is among the states with the most concentrated animal feeding operations. Concerns have been raised about the possible environmental impacts of these facilities, particularly the impact they have on water supplies. Communities must have clean drinking water. In each of the past two Congresses I have co-authored legislation to infuse significant Federal funds into the two State revolving loan funds to help communities meet their clean water obligations. Both bills would have also authorized grants for disadvantaged communities. Further, my legislation to reauthorize the Safe Drinking Water Act's small system technical assistance program was recently passed by the Committee.

We can have clean water and an active agriculture industry but we cannot have one at the expense of the other. I have been aggressive in assisting water systems comply with Federal laws however, any effort to further regulate farms must consider the critical economic and employment benefits provided by the nation's farms. In a 2000 study, the State Department of Agriculture found that of the over 111,000 agriculture jobs in Oklahoma, 71 percent were related to livestock production. According to the USDA, total farm and farm-related employment in Oklahoma in 2002 was 343,636 jobs. Any legitimate concerns should be addressed without threatening the economic viability of Oklahoma's agriculture industry.

It is rare that we have the privilege of two Oklahoma witnesses at one hearing but today we are joined by Drew Edmondson, Oklahoma's Attorney General and by Professor Michael Dicks of Oklahoma State University. It is always a great pleasure to have folks from home come before the Committee.

Conversely, I am disappointed that the Chairwoman refused to allow the Department of Agriculture to testify. USDA oversees a variety of programs, including the Environmental Quality Incentives Program to which so many farmers turn for compliance assistance. The USDA would have been able to provide much needed information for today's discussion.

Today's hearing will focus on several aspect of environmental protection, including clean air. One of our witnesses works with the Iowa Department of Natural Resources (DNR), yet is not representing Iowa. I wonder if that is because when Iowa's DNR studied the issue of odor, it found that relatively few problems, with fewer than 4 percent of the measurements taken near public areas, homes and businesses exceeding acceptable odor levels. Further, another Iowa study out of the University of Iowa found that every-day products, pets and smoking were the cause of ammonia emissions and not from CAFOs. Given these air studies, and the fact that industry is working diligently to provide EPA with monitoring data to assist EPA in its regulatory assessment, it seems clear that this is an example of government actually working.

I anticipate some discussion today from those who suggest that applying the nation's hazardous waste response law—Superfund—to CAFOs is the solution to protecting our communities' waters. The prospect of declaring animal manure a hazardous waste and thus regulating under CERCLA deeply concerns me. If animal manure is found to be a hazardous waste, then virtually every farm operation in the country could be exposed to liabilities and penalties under this act. Furthermore, how then do we categorize the producers of such "hazardous waste?" Are chickens and cows producers of hazardous waste and subject to CERCLA regulation as well? I do not believe this is what Congress intended. This issue needs a common sense approach where nature and sound science meet and I look forward to our discussion on it.

CAFOs are already regulated under the Clean Water Act. In 2003, EPA published a new regulation updating its CAFO program. The Second Circuit Court would later rule in its "Waterkeepers" decision that EPA could not require farmers with only a potential to discharge to have an N.P.D.E.S. permit. The Court correctly found that the Clean Water Act only regulates actual discharges, not potential discharges. The EPA will soon finalize a new rule to implement the Court's decision. For those who call for additional regulation, it is important to note that one of the current primary regulatory tools has not yet been fully implemented. We need to see how EPA's soon-to-be published rule, which for the first time regulates land application of nutrients, improves water quality.

Both Mr. Dove and Professor Dicks speak of converting manure into energy. This is innovation that would contribute to our nations' energy supply while addressing concerns about excess animal waste. Most people know that Oklahoma is a leader in the oil and gas world but Oklahoma also leads in developing innovative energy technologies. For example, I have highlighted the Noble Foundation's work with bioenergy crops while chairman and ranking member. Before the recess, I added a provision to the Senate energy bill that would promote geothermal energy for GSA buildings. Oklahoma City's Climatemaster is a national leader in this growing field. We need to encourage innovation in all fields, including animal waste.

This is an important hearing that will allow us to take a comprehensive look at the numerous Federal, State and local initiatives and authorities that already exist to address any pollution concerns related to livestock production. I look forward to hearing from all of our witnesses.

Senator BOXER. We are very happy you are back.

Now it is my honor to introduce Drew Edmondson, Attorney General, Oklahoma Office of Attorney General.

Welcome, sir.

STATEMENT OF DREW EDMONDSON, ATTORNEY GENERAL, OKLAHOMA OFFICE OF ATTORNEY GENERAL

Mr. EDMONDSON. Thank you. Thank you, Madam Chair, and thank you, Senator Inhofe, for your invitation to appear here this morning and, Senator Inhofe, thank you for being safe home from Iraq too. I appreciate that.

My written statement is obviously too lengthy to read, and I would ask that it be considered part of the record.

Senator BOXER. Without objection, so ordered.

Mr. EDMONDSON. In 2005, the State of Oklahoma filed a lawsuit after 3 years of unsuccessful negotiation against the major poultry companies in western Arkansas and eastern Oklahoma over degradation of the Illinois River watershed due to the surface application of poultry waste for many, many years.

Madam Chair, CAFOs are not normal agricultural operations which are exempt under CERCLA. These are not chickens in a yard, and you throw grain down and feed them and go in the next morning and see if they laid any eggs.

These are houses that hold as many 25,000 birds at a time. They turn over 4 to 5 crops a year which means a single house will have a 100 to 125,000 birds in it in a year, and a typical poultry farm will have from 3 to 20 houses. So you are talking about an enormous amount of waste that is generated at an industrial level by these operations.

The amount of phosphorus that is generated in the Illinois River watershed alone from these poultry operations would equal the untreated human waste of 10.7 million human beings, more than the population of Oklahoma, Arkansas and Kansas combined.

If we would contemplate, for just a second, taking the human waste of 10.7 million human beings and simply surface applying it to the land rather than sending it to treatment facilities, that is exactly what we are getting annually in a precious watershed in eastern Oklahoma and western Arkansas from poultry operations. That is why we felt it necessary to litigate when negotiation proved unsuccessful, and that is why we hope to be able to change the practice of the industry in western Arkansas and eastern Oklahoma.

It is about a one million acre watershed, lying roughly half in Arkansas and half in Oklahoma. There are nearly 3,000 poultry operations within that watershed, about 2,300 of them in Arkansas and the balance in the State of Oklahoma. So it is a shared problem, and we could only reach it through the Federal courts.

As has been mentioned, there are more chemical agents besides nitrogen and phosphorus. There is also arsenic. There is also selenium, zinc and copper and other trace elements as well as growth hormones and, of course, E. coli.

So there are significant problems. They resulted in degradation of that watershed and other watersheds in Oklahoma, and I dare say, notwithstanding the progress that has been made, the Chesapeake Bay remains degraded and work needs to be done in Delaware, Maryland and Virginia. Work needs to be done in Georgia.

I would suggest, if I may most humbly, that rather than looking at exempting these industrial size operations from the provisions governing clean water, that Congress might take a look at national legislation to prevent the surface application of untreated animal waste of an industrial level. That way the playing field will be level and different operations would not have competitive advantages, one against the other.

Senator Inhofe, thank you for mentioning my father and my uncle. They used to take me canoeing on the Illinois River. I took my children, picnicking and swimming on the Illinois River and Lake Tenkiller. The result of your work and our efforts in Oklahoma will determine whether or not my children can take their children to enjoy those same waterways.

Thank you very much.

[The prepared statement of Mr. Edmondson follows:]

STATEMENT OF DREW EDMONDSON, ATTORNEY GENERAL, OKLAHOMA OFFICE OF ATTORNEY GENERAL

STATEMENT SUMMARY

Chairman and Members of the Committee: Thank you for the opportunity to discuss the impacts of animal feeding operations on water quality. In particular, I am very concerned about efforts to amend CERCLA to re-define the term "hazardous substance" to exclude manure and anything that may be contained in or commingled with manure. Proposals such as Senate Bill 807, which is currently pending in the Senate, would eliminate an important tool in remedying the serious effects of pollution caused by industrial-scale animal feeding operations in the State of Oklahoma and throughout the United States.

As the Attorney General of Oklahoma, I have a unique perspective on the challenges presented by contamination from industrial animal feeding operations. For the past several decades, many of Oklahoma's eastern waterways have been severely impaired by the effects of poultry waste disposal. This pollution originates in northwestern Arkansas and eastern Oklahoma, where every year large-scale poultry operations dump massive amounts of poultry waste on fields and pasturelands. (*See* **Exhibit A**.) Often, there is no legitimate agricultural purpose or benefit associated with this practice. As a result of such practices, many of those fields and pasturelands have been transformed into virtual poultry-waste landfills.

This poultry waste can contain a number of substances such as phosphorus, nitrogen, arsenic, and pathogenic bacteria. Running off fields and pastures, this waste travels down through creeks and streams and into some of Oklahoma's most important and scenic waterways.

Unfortunately, the disposal of this waste has had, and continues to have, serious effects on Oklahoma's Illinois River Watershed and Lake Tenkiller, which are natural resources of unparalleled importance to the State of Oklahoma. Several rivers in the watershed, including Baron Fork Creek, Flint Creek and the Illinois River itself have been declared "State Scenic River Areas" by Oklahoma law. The Illinois River Watershed is noted for its aesthetic, ecological, recreational, and public-water-supply values, and the quality of its water is essential to the economy of the whole region. As a result of industrial-scale animal feeding operations, water quality in this area is seriously impaired. Elevated levels of phosphorus cause algae blooms that disrupt the ecosystem, and pathogenic bacteria threaten human health.

After several unsuccessful years trying to negotiate a resolution to this problem, in 2005, the State was forced to sue the integrated poultry companies to stop them from polluting Oklahoma's waterways. One of the most important tools available to the State is Section 107 of CERCLA, which allows Oklahoma to recover response costs and damages to its natural resources.

Now, there are proposals in Congress to eliminate CERCLA as a tool for responding to contamination from industrial-scale animal feeding operations in the future. For example, Senate Bill 807 proposes to exclude "manure" from the definition of hazardous substances, even though CERCLA already provides an exemption for the normal application of fertilizers, such as animal manure. (*See* 42 U.S.C. § 9601(22).) But apart from being an unnecessary change to CERCLA, amending CERCLA to exclude "manure" will severely limit Oklahoma's ability—and other States' ability—to respond to the release of hazardous substances from industrial-scale animal feeding operations. As I will describe, the release of hazardous substances from this industry is a serious problem across the nation. CERCLA currently provides a mechanism for the States to respond to the problem and hold these companies responsible, rather than using taxpayer funds to clean up the industry's pollution.

The integrated animal agriculture companies should be held responsible for their releases of hazardous substances into the environment, such as arsenic and phosphorus, in the same manner that every other industry is held responsible for releases of hazardous substances. Again, CERCLA already provides an exemption for the normal application of fertilizer, but it does not provide an exemption for massive disposal of animal waste and the resulting releases of hazardous substances. Further, the majority of animal feeding operations are not subject to the permitting requirements of the Clean Water Act, which focus primarily on nutrient pollution, and, thus, are not adequately addressed by other federal laws.

Because of CERCLA's importance in protecting our environment, and the devastating pollution caused by the industrial-scale animal feeding operations in the United States, I urge you to reject any attempts to exempt releases of hazardous substances associated with the improper disposal of animal waste from CERCLA.

I. THE GROWING PROBLEM OF POLLUTION FROM ANIMAL FEEDING OPERATIONS

A. Pollution from animal feeding operations is a nationwide problem.

In 2003, the EPA explained in its rules governing concentrated animal feeding operations that "agriculture . . . is the leading contributor to identified water quality impairment in the nation's rivers and streams, lakes, ponds, and reservoirs."[1] The

[1] 68 Fed. Reg. 7176-01, 7237 (2003) (NPDES Guidelines for CAFOs).

agricultural sector is reported to contribute to the impairment of 129,000 miles of the Nation's rivers and streams, 3.2 million lake acres, and more than 2,800 estuarine square miles.[2] As a comparison, agriculture is reported to impair nearly four times as many river and stream miles as the pollution resulting from urban runoff and storm sewers.[3]

In particular, animal feeding operations are major sources of groundwater and surface water pollution. The USDA estimates that confined livestock and poultry operations generate about 500 million tons of manure annually, which is three times more raw waste than is generated by humans in the United States.[4] The pollution that results from this waste is staggering. According to the EPA in its 2000 Water Quality Inventory Report, the amount of pollution specifically attributed to animal feeding operations by reporting states is roughly comparable to the amount of pollution attributed to the entire mining and resource extraction industry in the United States.[5]

Further illustrating the truly interstate nature of this problem, many poultry industry operations are grouping along state borders. (*See* **Exhibit B.**) As in many areas across the United States, there is major expansion going on along the borders of Oklahoma, Arkansas, and Missouri.

B. The manure generated at animal feeding operations has increased dramatically and so has the resulting contamination.

Pollution from animal feeding operations has dramatically increased, and for a logical reason.[6] Traditionally, animal manure has been applied directly to the land, because while animal manure is a waste, it can also be used in appropriate circumstances

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[2] 68 Fed. Reg. 7176-01, 7237 (2003) (citing the 2000 National Water Quality Inventory Report, "NWQIR", available at http://www.epa.gov/305b/2000report/).
[3] 2000 NWQIR at 14.
[4] 68 Fed. Reg. 7176-01, 7180 (2003).
[5] 2000 NWQIR at pg. 14.
[6] "Proposed Regulation to Address Water Pollution from Concentrated Animal Feeding Operations" EPA 833-F-00-016 (2000).

as a fertilizer. In fact, land application is the predominant means of animal manure disposal.[7] But while the amount of animal manure has risen significantly (20% increase between 1982 and 1997), the amount of available cropland and pastureland has declined significantly (nearly 40% during the same time period).[8] In short, more animal waste is being applied to less land. And when waste is excessively or improperly land-applied, the nutrients and other materials contained in the waste become pollutants that, as one court noted, "can and often do run off into adjacent waterways or leach into soil and groundwater."[9]

The poultry industry is a telling example of this explosive trend. In 1934, the United States produced an estimated 34 million broilers.[10] Compare that to 2006, when the United States produced over 8.8 billion broilers. In Arkansas alone, where many watersheds drain into Oklahoma, there were over 1.2 billion broilers produced in 2006.[11]

This dramatic increase in broiler production has lead to a corresponding increase in pollution from poultry operations. For example, the USDA estimates that confined poultry operations account for the majority of on-farm excess nitrogen.[12] But nationwide, on-farm use is able to absorb less than 10% of the total available nitrogen.[13] That means that more than 90% of the nitrogen generated by poultry waste cannot be absorbed by the land available on-farm.

And nitrogen is just one potentially harmful constituent of poultry waste. In addition to nitrogen, the primary pollutants most commonly associated with animal waste

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[7] 66 Fed. Reg. 2960, 2976-79.
[8] 68 Fed. Reg. at 7180.
[9] *Waterkeeper Alliance, Inc. v. U.S. E.P.A.*, 399 F.3d 486, 495 (2d Cir. 2005).
[10] USDA, Economics, Statistics, and Market Information System (2007), available at usda.mannlib.cornell.edu, "Poultry Production and Value, 04.27.2007_revision".
[11] *Id.*
[12] 68 Fed. Reg. at 7180.
[13] *Id.*

are phosphorus, ammonia, organic matter, solids, pathogens, odorous compounds, trace metals, pesticides, antibiotics, and hormones.[14] Trace elements in manure that are of environmental concern include arsenic, copper, selenium, zinc, cadmium, molybdenum, nickel, lead, iron, manganese, aluminum, and boron.[15]

In order to achieve the growth rates which make it possible for a single poultry house to raise 5.5 flocks in a year, broiler feed has been carefully engineered. Arsenic, copper, selenium, and zinc have all been added to the feed to promote growth and inhibit parasites.[16] These metals are not naturally occurring in animal waste. A recent U.S. EPA National Exposure Research Laboratory report states that:

> Organic arsenic compounds are extensively added to the feed of animals (particularly poultry and swine) in the United States to improve growth rates by controlling parasitic diseases. The resulting arsenic-bearing wastes are currently introduced to the environment, and even used to fertilize croplands.[17]

Many of the above-mentioned pollutants can seriously impact human health and the environment. Excess phosphorus and nitrogen causes eutrophication that affects "the dissolved oxygen content of a water body to levels insufficient to support fish and invertebrates."[18] Eutrophication can also cause the growth of toxic organisms such as cyanobacteria, which can be harmful to both humans and wildlife.[19] Eutrophication also impacts drinking water by "clogging treatment plant intakes, producing objectionable tastes and odors, and increasing production of harmful chlorinated byproducts (e.g.,

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[14] 68 Fed. Reg at 7181.
[15] 66 Fed. Reg. at 2978.
[16] 66 Fed. Reg. at 2985.
[17] Momplaisir, G. M; C. G. Rosal; E. M. Heithmar "Arsenic Speciation Methods for Studying the Environmental Fate of Organoarsenic Animal-Feed Additives," U.S. EPA, NERL- Las Vegas, 2001; (TIM No. 01- 11). Available at: http://www.epa.gov/nerlesd1/chemistry/labmonitor/labresearch.htm.
[18] 66 Fed. Reg. at 2982.
[19] 66 Fed. Reg. at 2981.

trihalomethanes) by reacting with chlorine used to disinfect drinking water."[20] Trihalomethanes can cause cancer.[21] Selenium is associated with liver dysfunction and loss of hair and nails, and zinc can result in changes in copper and iron balances, particularly copper deficiency anemia.[22] All of these substances can be present in poultry waste–the same waste that is intentionally dumped on fields by the integrated poultry industry and that then runs into streams, rivers, and lakes, many of which are public water supplies.

Importantly, Senate Bill 807 would insulate all of these dangerous substances from the provisions of CERCLA because the bill proposes to exempt "manure," which is defined to include anything that might be contained in or commingled with manure. (*See* proposed Sec. 313(a)(4) of bill.)

C. The increased pollution is the result of the large, industrial-scale producers – not the smaller family farms.

Importantly, this rising tide of agricultural pollution is being caused by modern, industrial-scale integrated agricultural operations, not the smaller, traditional family farms. The scale of present-day industrialized animal feeding operations dwarfs the historically smaller, family-run farms in terms of environmental pollution. As the Second Circuit Court of Appeals recently wrote, speaking of the current large-scale animal feeding operations: "[s]uch 'agricultural enterprises' are not, however, of a kind the Founding Fathers likely would have envisioned populating America's 'yeoman republic.'"[23]

[20] 66 Fed. Reg. at 2982.
[21] http://www.epa.gov/safewater/hfacts.html
[22] 66 Fed. Reg. at 2984.
[23] *Waterkeeper Alliance, Inc.*, 399 F.3d at 492.

In the first half of the twentieth century a farm might have a chicken coop or brooder house that might hold 500 chickens; a large one might hold 1,400 birds.[24] A modern poultry house can house a 25,000-bird flock at one time producing an average of 5.5 flocks per year and 125 tons of poultry waste annually.[25]

Today, in Eastern Oklahoma and Northwest Arkansas, each poultry operation will generally have more than one house. (*See* **Exhibit C**, aerial photographs of typical industrial-scale poultry feeding operations.) The industry average is 2.3 houses per operator and some of these operations have four or more houses at one location.[26] The EPA has found that the trend for "animal feeding operations" has been "toward fewer but larger operations" resulting in concentration of "more manure nutrients and other waste constituents within some geographic areas." [27] Moreover, large operations often "do not have sufficient land to effectively use the manure as fertilizer."[28]

EPA has further noted that this concentration has resulted in "widespread phosphorus saturation of the soils" in some areas of the United States and that "research shows a high correlation between areas with impaired lakes, streams and rivers due to nutrient enrichment and areas where there is dense livestock and poultry production."[29] The USDA has estimated that confined poultry operations "account for the majority of

[24] "Early Poultry Houses", Iowa Barn Foundation, 2004, available at http://www.iowabarnfoundation.org/magazine/early_poultry_houses.htm
[25] "Nutrient Analysis of Poultry Litter and Possible Disposal Alternatives", Avian Advice, University of Arkansas, Fall 2003, Vol. 5, No. 3, p. 1.
[26] Holleman, John T., *In Arkansas Which Comes First, The Chicken or the Environment*, TULANE ENVIRONMENTAL L. R., Vol. 6, p. 21, 26.
[27] 68 Fed. Reg. at 7180.
[28] *Id.*
[29] 68 Fed. Reg. at 7196.

on-farm excess nitrogen and phosphorus . . ." because of the generally higher nutrient composition of poultry waste and the lack of land available for application.[30]

In the United States, in 1997, 165 counties had the potential for excess manure nitrogen and 374 counties had the potential for excess manure phosphorus primarily because of the lack of available land application areas.[31] In 1999, the USDA, speaking about the build up of phosphorus in soils where the wastes from concentrated animal production facilities were disposed of, warned:

> Phosphorus accumulation on farms has built up soil P to levels that often exceed crop needs. Today there are serious concerns that agricultural runoff (surface and subsurface) and erosion from high P soils may be major contributing factors to surface water eutrophication. . . . By the time these water-quality impacts are manifest, remedial strategies are difficult and expensive to implement; they cross political and regional boundaries; and because of P loading, improvement in water quality will take a long time.[32]

The family farm with its hundreds of birds had plenty of uses for the manure the birds produced. With a single poultry house producing 125 tons of manure every year, the poultry industry often lacks appropriate locations to properly to dispose of its waste. The University of Arkansas Extension Service explained the problem as follows:

> The Arkansas poultry industry generates 1.4 million tons of broiler litter annually. While litter is still a valuable fertilizer resource that is needed in many areas, litter generated in poultry producing regions cannot be properly utilized in those regions alone. By some estimates, alternative uses for perhaps as much as half of the litter generated in concentrated production areas must be found.[33]

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[30] 68 Fed Reg. at 7180.
[31] 68 Fed. Reg. at 7180-81.
[32] "Agricultural Phosphorus and Eutrophication", USDA, ARS 146, July 1999, p. 4.
[33] "Nutrient Analysis of Poultry Litter and Possible Disposal Alternatives", supra at pg. 4.

CERCLA liability simply by properly spreading manure on crops or cropland at agronomic rates in compliance with best management practices.

The meaning of CERCLA's current exclusion is illuminated in the Senate Report for the CERCLA legislation as follows:

> Certain feedstocks used to produce fertilizer (nitric acid, sulfuric acid, phosphoric acid, anhydrous ammonia) are hazardous substances as defined by the bill, and certain fertilizer products may be listed as hazardous substances as well. . . . Under this exclusion, however, the "normal field application" of fertilizer is not a "release" as defined in the bill. . . . The term "normal field application" means the act of putting fertilizer on crops or cropland, and does not mean any dumping, spilling, or emitting, whether accidental or intentional, in any other place or of significantly greater concentrations or amounts than are beneficial to crops.[38]

In passing the CERCLA legislation, the Senate bill was adopted by the House without amendment, and when this happens, "the Senate report is powerful evidence of congressional intent."[39]

The current "normal application of fertilizer" provision of CERCLA is adequate to protect all legitimate uses of animal manure. This provision does not indicate Congressional intent to completely exempt animal manure and associated releases of hazardous substances from CERCLA. Proposals such as Senate Bill 807 would represent a 180-degree change in this carefully considered environmental law

E. The Clean Water Act does not regulate most confined animal feeding operations.

Proponents of the exemption also suggest that CERCLA should not apply to releases of hazardous substances from the disposal of animal manure because the industry

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[38] S. Rep. No. 96-848, at 46 (1980).
[39] *State of Colorado v. United States Department of Interior*, 880 F.2d 481, 487 (D.C. Cir. 1989).

is already heavily regulated by the Clean Water Act. This is simply not true. The majority of the estimated 238,000 animal feeding operations are not currently regulated by the EPA under the Clean Water Act. In 2003, EPA passed a new CAFO rule expanding coverage under the Clean Water Act, but even under that new rule, only 15,500 animal feeding operations are reported to be regulated.[40] This means that EPA's CAFO rule only regulates 6.5% of all animal feeding operations in the United States.

II. THE SERIOUS EFFECTS OF POLLUTION FROM POULTRY WASTE DISPOSAL ON THE STATE OF OKLAHOMA

In my statement so far, I have attempted to illustrate the growing problem of pollution from animal feeding operations across the country. Now, I will highlight the particular effects of poultry waste disposal on the State of Oklahoma, and how the State is using CERCLA to remedy this pollution. If animal manure is exempted from the provisions of CERCLA, however, poultry waste and its harmful effects will be completely outside the provisions of CERCLA, and Oklahoma will lose an important tool to use in the future to protect its citizens and natural resources from the release of hazardous substances by animal feeding operations.

A. Oklahoma has been seriously damaged by the effects of large-scale, industrial poultry production.

The Illinois River Watershed, known as the "IRW", consists of approximately 1,000,000 acres of land that straddles the Arkansas-Oklahoma border. In 1970, the Oklahoma Legislature designated the Illinois River and portions of its tributary rivers, Baron Fork Creek and Flint Creek, as "State Scenic River Areas."[41] The designation as "Scenic River Areas" reflects a recognition by the Oklahoma Legislature that these rivers

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[40] U.S Environmental Protection Agency, *Summary of the Second Circuit's Decision in the CAFO Litigation*, http://www.epa.gov/npdes/pubs/summary_court_decision.pdf.
[41] 82 Okla. Stat. § 1452 (1970).

and streams "possess such unique natural scenic beauty, water conservation, fish, wildlife, and outdoor recreational values of present and future benefit to the people of the state that it is the policy of the Legislature to preserve these areas for the benefit of the people of Oklahoma."[42] Early travelers to the region described the Illinois as an exceptional river as follows: "On the east side of the Arkansas is the Illinois River, rising in the mountainous regions southeast of Fort Gibson, said to be one of the prettiest rivers on the continent, sparkling with crystal waters."[43] (*See* **Exhibit D**, photograph of the Illinois River.)

Our State Scenic Rivers are also designated as "outstanding resource waters" for protection of their beneficial uses such as aesthetics, recreation, public water supply, and fish and wildlife propagation.[44] Tourism has been especially important to Oklahoma's economy because the Illinois River is a noted recreational destination for floating, fishing, camping, swimming, diving, hiking, and sightseeing. In addition, the IRW also serves as an important source of drinking water to Oklahoma citizens. There are a number of communities and rural water districts that depend on the IRW.

The Illinois River feeds into the 12,900-acre Tenkiller Ferry Lake, which has been described as the emerald jewel in Oklahoma's crown of lakes. Like the river from which it is formed, before it began to deteriorate, Tenkiller was known for its pristine waters:

> Tenkiller is Oklahoma's most beautiful lake. . . . For a distance of more than 30 miles above the dam near Gore that holds back its deep, crystal clear waters, it stretches in

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[42] *Id.*
[43] Reports of the Board of Indian Commissioners. Appendix 37. Second Annual Report 1870 (Fort Gibson, Indian Territory, December 16, 1870), reprinted in Chronicles of Oklahoma Vol. 5, No. 1 (March 27) at 80.
[44] See Okla. Admin. Code 785:45-3-2.

> a northeasterly direction through the fabled and picturesque Cookson Hills.[45]

Lake Tenkiller serves as a valuable source of drinking water, and currently, the primary recreational activities at Lake Tenkiller include boating, fishing, camping, swimming, and sightseeing.

B. Poultry Integrator Company Operations in the Illinois River Watershed.

In this river basin are some of the most concentrated poultry growing operations in the country. It is the home of Tyson Foods and several other poultry integrator companies. Arkansas is ranked second in broiler production in the United States and Washington and Benton Counties through which the Illinois River and its major tributaries flow form the center of this industry in Arkansas. As of 2002, there were an estimated 2,871 poultry houses in the IRW. (*See* **Exhibit E**, poultry houses in Oklahoma and Arkansas.) The estimated phosphorus in the waste produced by poultry in the IRW is the equivalent to the waste stream of <u>10.7 million people</u>. That is more people than live in all of Arkansas, Kansas, and Oklahoma combined.

In the IRW, the poultry companies own millions of chickens and turkeys that generate hundreds of thousands of tons of waste. As explained above, the constituents of the poultry waste can include, but are not limited to, phosphorus, nitrogen, arsenic, zinc, copper, hormones, and microbial pathogens. Phosphorus, arsenic, zinc, and copper are designated hazardous substances under CERCLA.[46] Generally, this waste has been improperly stored in large piles that are not protected from the elements and disposed of on lands within the IRW in excess of crop agronomic needs and soil capacity. (*See*

[45] C. Brill, *1957 Brill's Oklahoma Outdoor Guide* at 169 (Oklahoma City Consolidated Publishing Company).
[46] 40 C.F.R. § 302.4

Exhibits A and F, photographs of waste-disposal practices.) These practices are causing an accumulation of hazardous substances, pollutants and contaminants in the soils and are causing runoff and release of large quantities of phosphorus and other waste constituents into the waters of the IRW.

C. Effects of Poultry Integrator Companies on the Illinois River Watershed.

The IRW is highly susceptible to pollution from land application of animal waste because of the geology of the area. As one commentator notes, "[t]he fractured limestone geology of the region allows a direct linkage from surface waters to groundwaters."[47] In layman's terms, the geology of the area allows contaminants placed onto the land to easily (and quickly) flow into the groundwater and surface waters. The importance of this fact has been described as follows:

> From a geologic standpoint, the center of the poultry industry could not be placed in a worse area. These two counties [Benton and Washington] are located in the Ozark Highlands region of the state. This area is noted for its mountainous terrain with steep gradients and fast-flowing, spring fed streams. A large percentage of the streams from within this region are designated as extraordinary resource waters.[48]

As a result of the waste disposal practices of the poultry industry, this once-pristine watershed is seriously impaired. The surface water impacts caused by the phosphorus released from the poultry industry's operations are well-known and well-documented in both government reports and peer reviewed literature. Releases of phosphorus have caused violations of state water quality standards, periodic algae blooms, excessive algal growths, and other adverse impacts in the waters of the IRW,

[47] Holleman, John T., *In Arkansas Which Comes First, The Chicken or the Environment*, TULANE ENVIRONMENTAL L. R., Vol. 6, p. 26.
[48] *Id.*

resulting in eutrophication, degradation in water quality and sediments, injury to biota, and impaired beneficial uses of the water. (*See* **Exhibits G & H**.) Many samples of runoff taken in the 2005-2006 timeframe at the edge of fields where poultry waste has been applied in the IRW show bacteria counts in the range of those reported for raw sewage (or surface waters into which raw sewage has been spilled). Segments of the Illinois River, Baron Fork Creek, and Flint Creek are impaired by bacterial contamination and are not meeting the standards for primary body contact recreation. Additionally, bacteria, nutrients, and metals have been reported to chronically exceed background levels in certain locations in the groundwater in the IRW.[49]

In spite of the amount of waste produced by the industry in this region, the hazardous nature of that waste, the dangers of bacterial contamination and the unsuitable nature of the geology in this region for such practices, the poultry industry continues to dispose of large volumes of untreated animal waste by spreading it onto the ground in the IRW. Although poultry waste is not the only source of contamination, it is clearly the predominant source in the watershed.

Moreover, it is important to note that the IRW is not the only watershed affected by the poultry waste disposal practices of this industry. Several other watersheds in eastern Oklahoma are impacted to varying degrees by poultry operations. (*See* **Exhibit I**, poultry houses in other Oklahoma watersheds.)

D. CERCLA's key role in Oklahoma v. Tyson

The State of Oklahoma first began discussions with the poultry industry to stop pollution of the State's natural resources by improper animal waste disposal in November

[49] Graening, G.O., Brown, A.V. 2001, *Protection of Cave Springs Cave Biota and Groundwater Basin*, Arkansas Water Resources Center Publication No. MSC-297. p. 1.

2001. In the years that followed, Oklahoma attempted a number of settlement mechanisms in order to prevent litigation, including informal negotiations through the Arkansas Attorney General, a joint negotiation with Arkansas and Oklahoma agencies with the assistance of Region VI of the U.S. Environmental Protection Agency, and a formal mediation with the assistance of retired United States District Judge Thomas Brett, assisted by former Region EPA VI Administrator, Gregg Cooke. All of these efforts failed to bring resolution to this very serious problem.

On June 13, 2005, the State of Oklahoma filed a lawsuit against fourteen poultry companies for pollution of the IRW. The case, *State of Oklahoma v. Tyson Foods, Inc.*, et al., Case No. 4:05-cv-000329-GKF-SAJ, was filed in federal District Court for the Northern District of Oklahoma. The Complaint alleges that the poultry companies are legally responsible for the waste, the improper disposal of the waste and the resulting pollution, damage and injury to natural resources in the IRW. Accordingly, the lawsuit does not name any individual farmers, commonly referred to as "contract poultry growers" or "contract poultry producers," with whom the poultry companies often contract to raise their birds and manage their waste. Rather, the lawsuit is directed at the actions of the poultry companies who either own or control the poultry operations in the IRW.

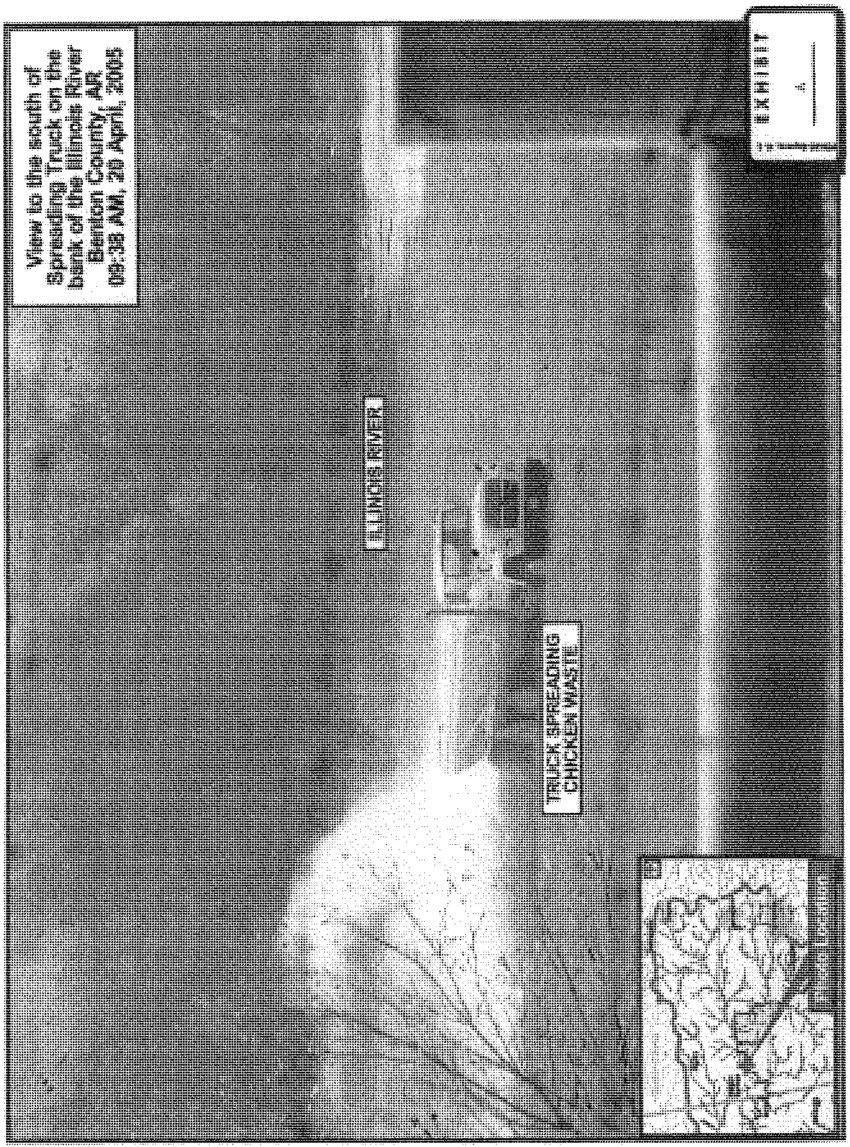
The Amended Complaint includes four counts based on federal law, including cost recovery and natural resource damage claims under CERCLA, 42 U.S.C. § 9607, an Imminent and Substantial Endangerment claim for injunctive relief and other available remedies under the Solid Waste Disposal Act, 42 U.S.C. § 6972 ((a)(1)(B) and (b)(2)(A)), and equitable relief, costs and damages under the federal common law of nuisance. The Complaint also includes state law claims. The State seeks, among other things, abatement, remediation, damages, declaratory relief, costs, penalties, and equitable relief. In sum, the State is seeking to stop the actions of the poultry companies which are causing pollution, to clean up the pollution, to restore the natural resources that have been injured, and to compensate the public for the damages done by the industry's practices.

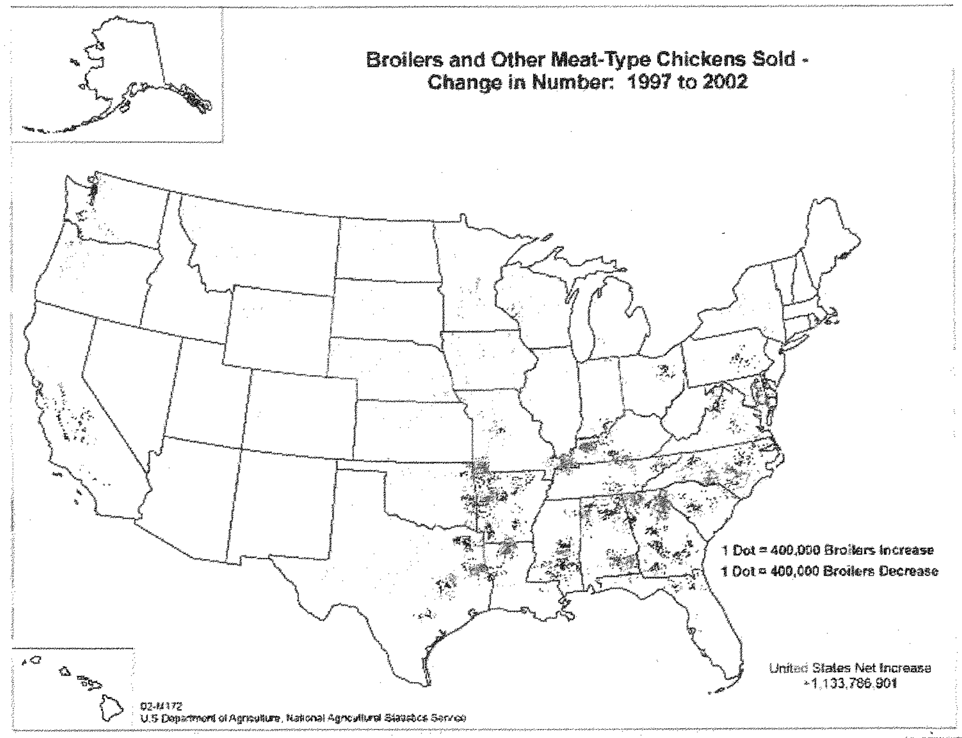
III. CONCLUSION

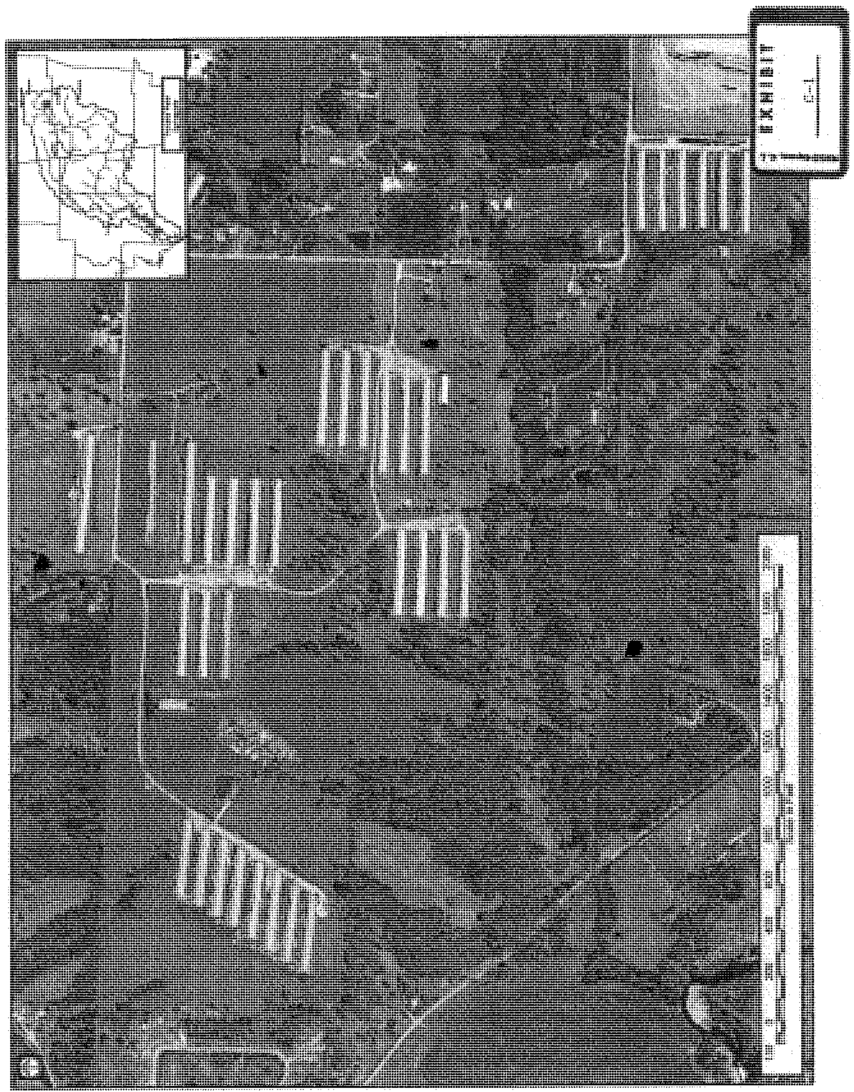
In conclusion, I would like to emphasize that pollution from industrial-scale animal feeding operations is a serious and growing problem. States, like Oklahoma, need legal tools to help stop and clean up animal-waste contamination, which is destroying significant and irreplaceable public resources such as the Illinois River Watershed. Fortunately, CERCLA is there to provide one tool to help states, like Oklahoma, to remedy this problem.

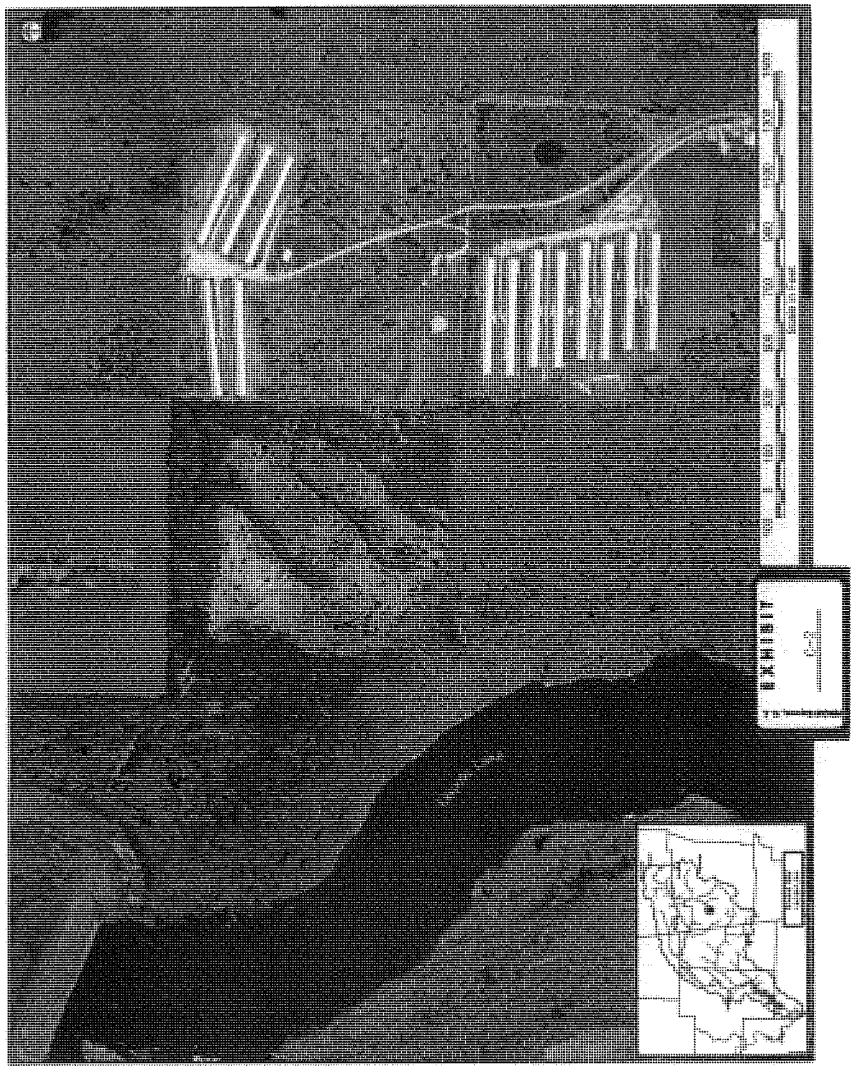
Unfortunately, there appears to be a coordinated effort to weaken CERCLA by exempting all animal waste, and anything that might be included in or commingled with that waste, from its provisions. Proponents of this effort claim that it is aimed at helping the family farmer, and that its purpose is simply to clarify that the already-overregulated animal agriculture industry is exempt from CERCLA. But these are all mischaracterizations. These efforts are not an effort to protect the family farmer. They are a transparent attempt to protect the industrial-scale animal feeding operation practice of dumping animal waste in an environmentally damaging manner. No other industry in the country has that kind of protection. Since adoption of the federal clean water and air legislation, no other industry has so callously polluted our land and waters. Nor is the proposed exemption designed to clarify the intent of CERCLA; rather it represents a 180 degree change from established CERCLA precedent

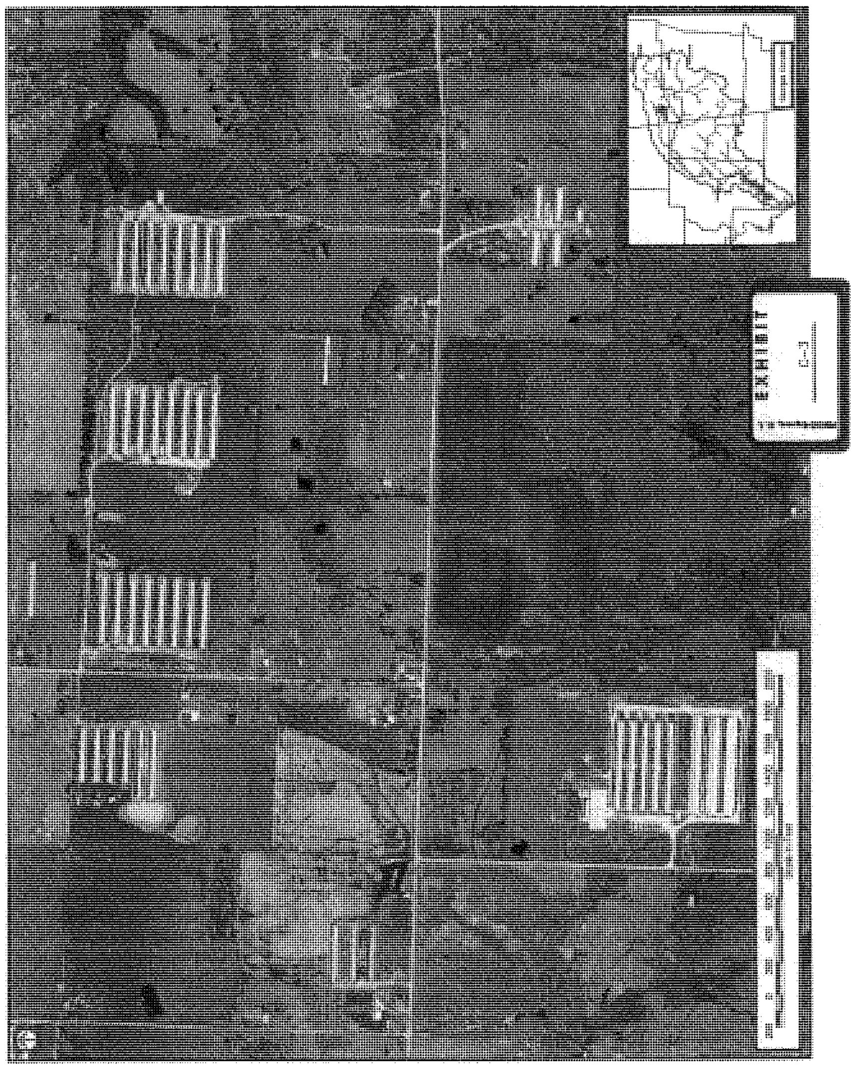
Thank you again for the opportunity to present my views to the Committee on this issue of national importance.


View to the south of
Spreading Truck on the
bank of the Illinois River
Benton County, AR
09:38 AM, 20 April, 2005
ILLINOIS RIVER
TRUCK SPREADING
CHICKEN WASTE
EXHIBIT


Broilers and Other Meat-Type Chickens Sold -
Change in Number: 1997 to 2002
1 Dot = 400,000 Broilers Increase
1 Dot = 400,000 Broilers Decrease
United States Net Increase
+1,133,786,901
02-M172
U.S Department of Agriculture, National Agricultural Statistics Service



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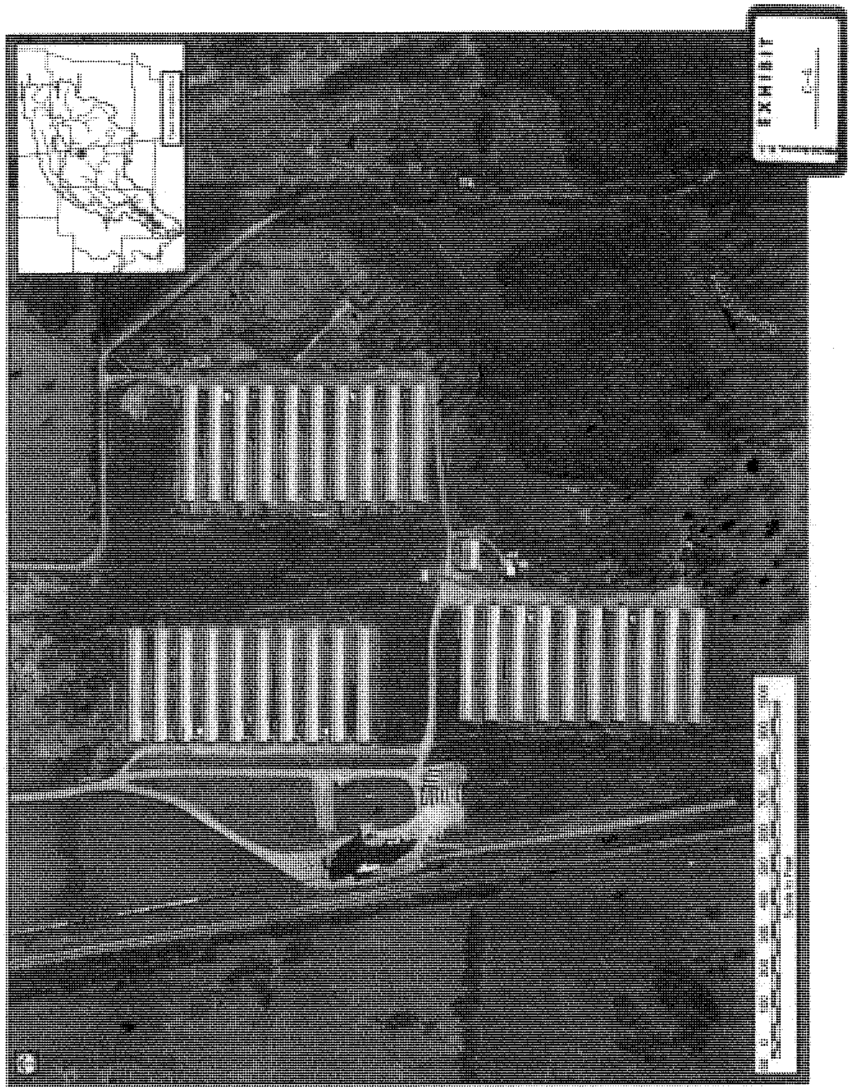
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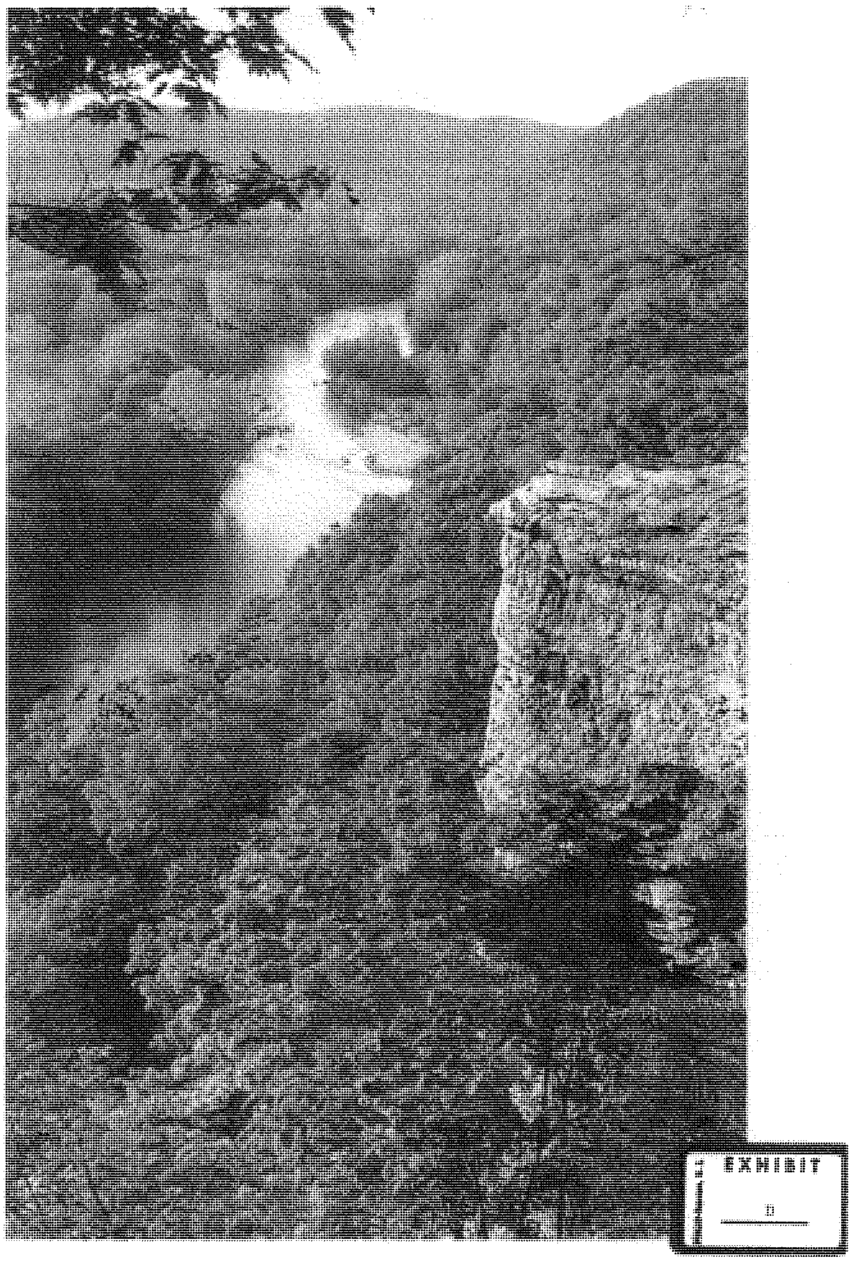
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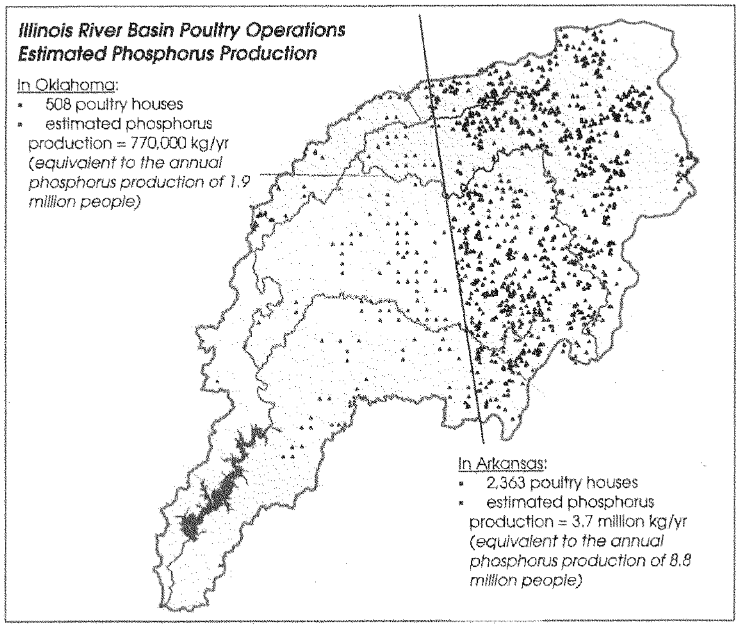

From "Illinois River Basin Tour" guide (Oklahoma Water Resources Board; August 12, 2002)

EXHIBIT

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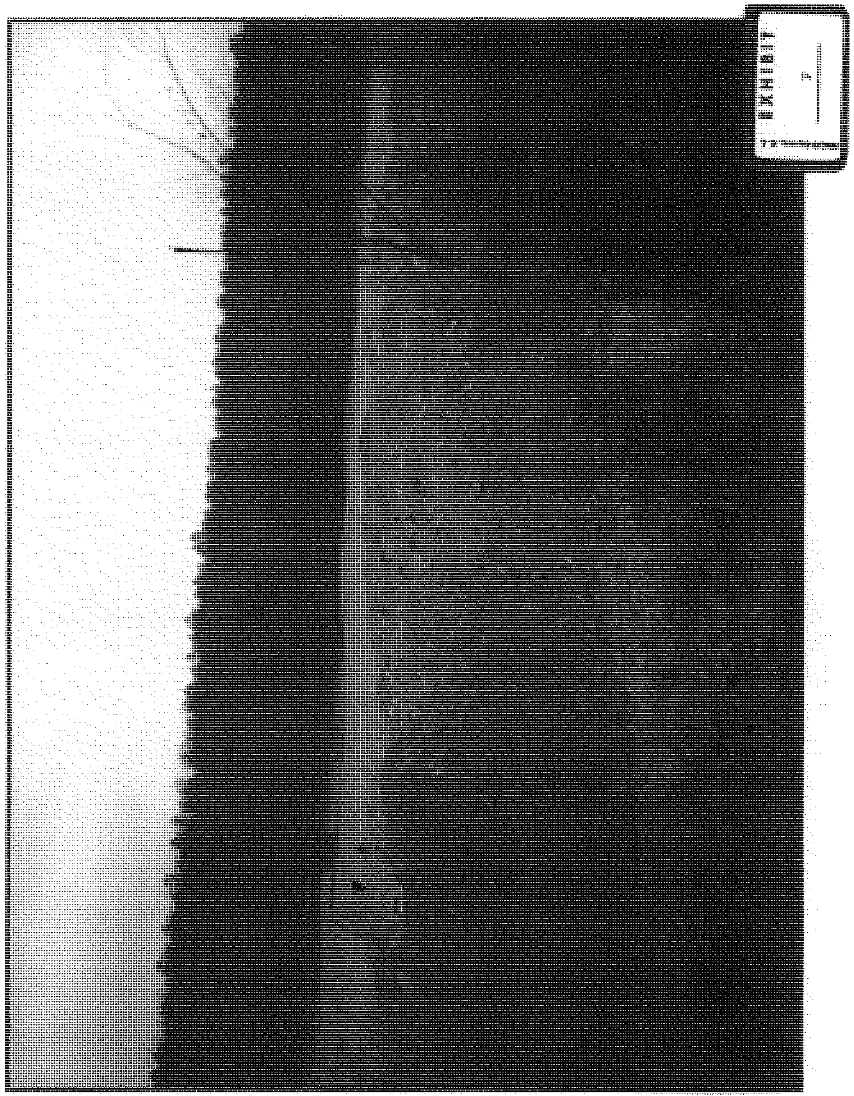


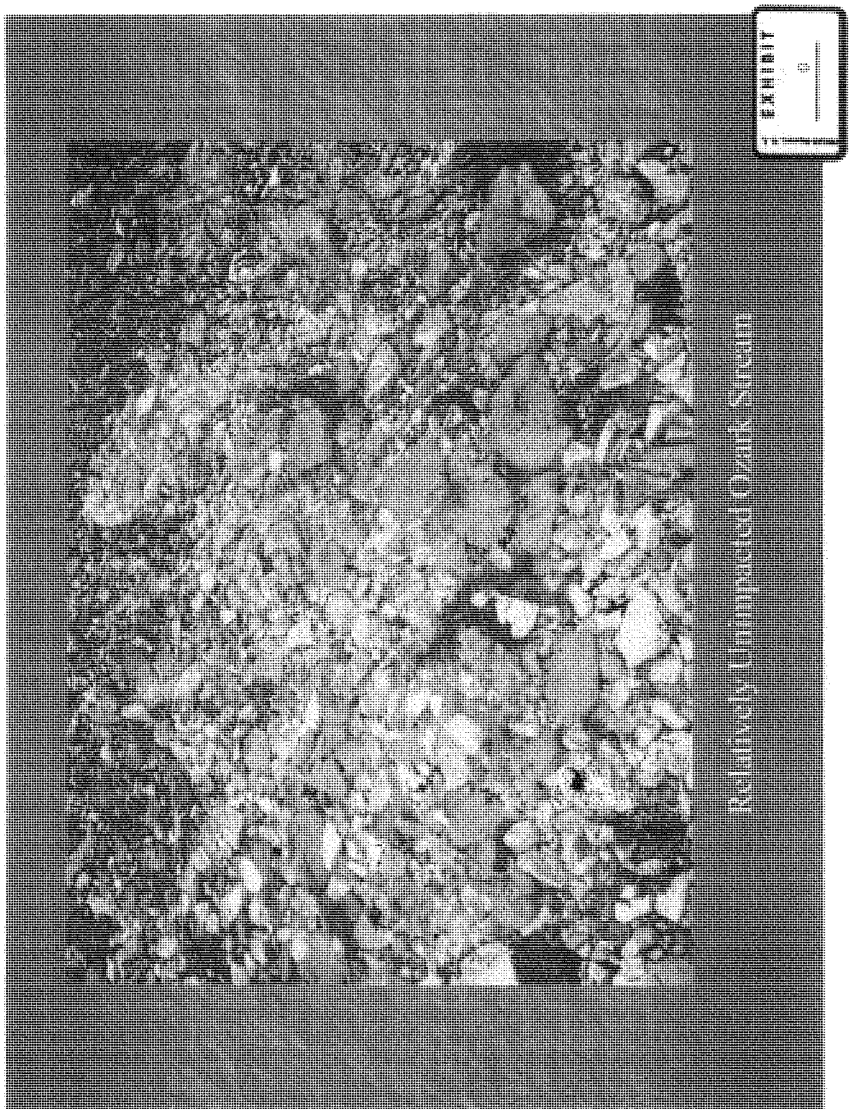
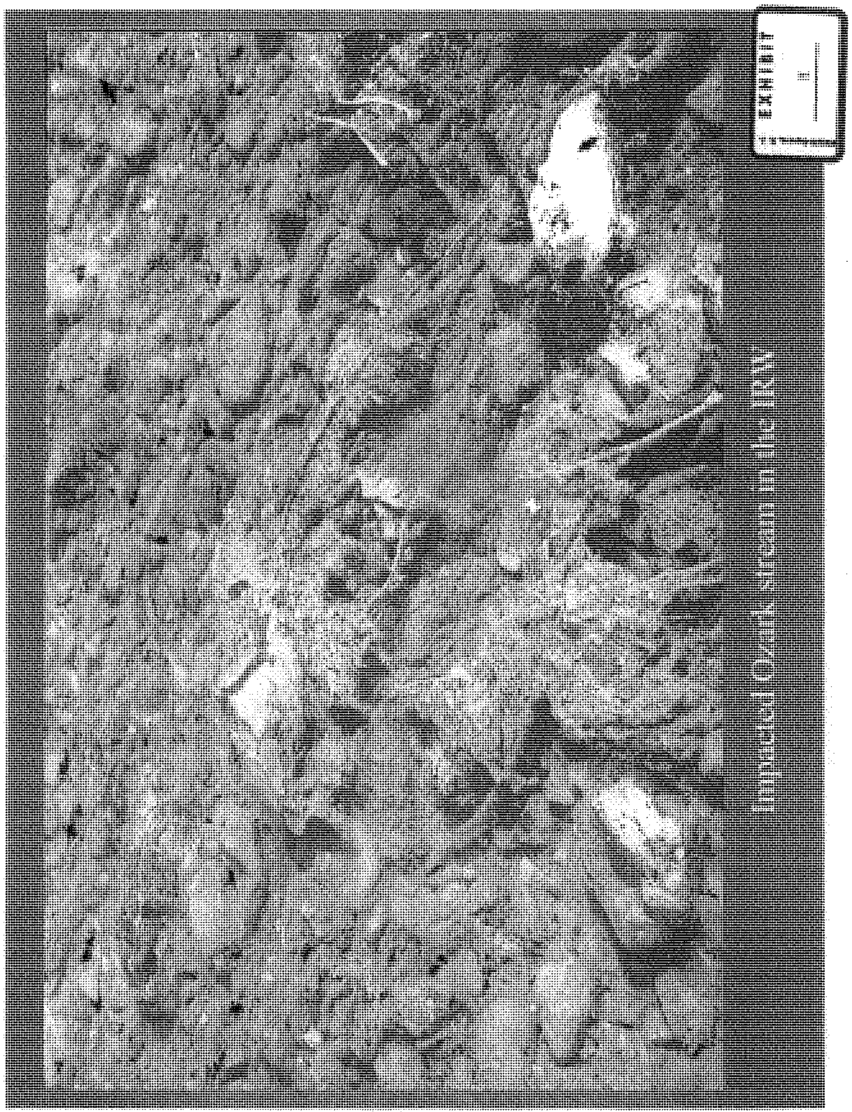
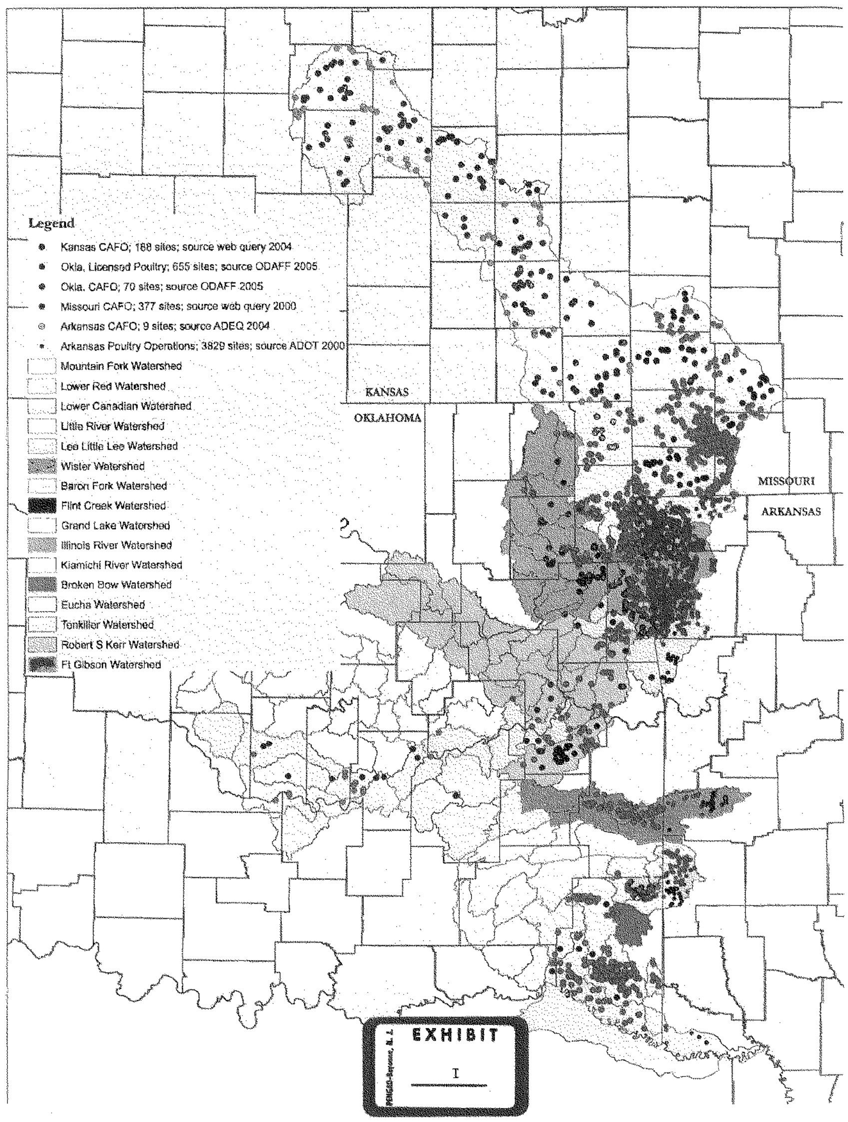


EXHIBIT
Relatively Unimpacted Ozark Stream


Impacted Ozark Stream in the IRW
EXHIBIT



Legend
Kansas CAFO; 188 sites; source web query 2004
Okla. Licensed Poultry; 655 sites; source ODAFF 2005
Okla. CAFO; 70 sites; source ODAFF 2005
Missouri CAFO; 377 sites; source web query 2000
Arkansas CAFO; 9 sites; source ADEQ 2004
Arkansas Poultry Operations; 3829 sites; source ADOT 2000
Mountain Fork Watershed
Lower Red Watershed
Lower Canadian Watershed
Little River Watershed
Lee Little Lee Watershed
Wister Watershed
Baron Fork Watershed
Flint Creek Watershed
Grand Lake Watershed
Illinois River Watershed
Kiamichi River Watershed
Broken Bow Watershed
Eucha Watershed
Tenkiller Watershed
Robert S Kerr Watershed
Ft Gibson Watershed
KANSAS
OKLAHOMA
MISSOURI
ARKANSAS
EXHIBIT
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Senator BOXER. Thank you, sir.

Olin Sims, President, National Association of Conservation Districts.

STATEMENT OF OLIN SIMS, PRESIDENT, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS

Mr. SIMS. Good morning, Madam Chairman and members of the Committee.

My name is Olin Sims, President of the National Association of Conservation Districts and a rancher from McFadden, Wyoming.

Established under State law, conservation districts, nearly 3,000 across the country, are local units of State Government, charged with carrying out programs for the protection and management of natural resources at the local level. We share a single mission: to support voluntary incentive-based programs that present a range of options, providing both financial and technical assistance to guide land owners in the adoption of conservation practices.

Districts help producers participate in Farm Bill programs like the cost-share Environmental Quality Incentives Program, and districts also utilize EPA's 319 Non-Point Source Grant Program to address concerns on animal feeding operations.

NRCS' conservation technical assistance program is the backbone for these Federal programs as well as State and local programs. Technical assistance is the individualized guidance and information that helps a landowner make a needed change to their operation.

Each State addressed livestock producers' needs differently. Today, I am pleased to share examples of our members' work across this great Country. In my home State, the Wyoming Association of Conservation Districts, in cooperation with Federal and State partners, initiated an animal feeding operation program in 1997.

The goals of the efforts were to, No. 1, inform and educate livestock producers on potential impacts of AFOs on water quality and other resources and regulatory requirements. No. 2, establish demonstration projects and, No. 3, provide the necessary cost-share and technical assistance to Wyoming's livestock industry.

Fifteen demonstration project sites on animal feeding operations were implemented, and additional efforts to fund several animal feeding operation projects to address impairments on surface waters within the State.

To my friend to the right from Oklahoma, the Oklahoma Association and the Conservation Commission addressed water pollution in two different watershed projects. Utilizing voluntary incentive-based programs to reduce phosphorus loading in the watersheds, the State also entered into an agreement on a conservation reserve enhancement program with USDA and the State technical committee prioritized certain watersheds as EQIP priority areas, focusing efforts where they were most needed.

The South Dakota Association of Conservation Districts and their member districts worked to provide technical assistance to producers to implement nutrient management plans.

Once a CNMP is complete, a producer frequently needs assistance with the plan's requirements and guidance on maintaining their operation to comply with the plan. Districts teach producers how to correctly obtain soil, water and manure samples and how to interpret the results, so they can correctly apply the required amounts. Plans are reviewed annually with the producer to determine success and identify needed changes with a long term goal of the producer gaining the technical skills to manage their own CNMP.

Soil and water conservation districts in North Carolina, that are present with us here today, partner with the State Soil and Water Conservation Commission to lead an aggressive and proactive effort dealing with the State's major livestock and poultry industries. In 1983, the North Carolina General Assembly authorized the North Carolina Agricultural Cost-Share Program to improve water quality associated with agricultural and 3 nutrient sensitive areas covering 16 counties. In 1990, the program was expanded statewide due to its success.

While the program addresses a range of agricultural-related water quality issues, 2,500 permitted facilities are often the focus of the activities. Approximately $58.1 million of the funds have been directed to CAFOs and AFOs.

This year, North Carolina passed and the Governor just recently signed legislation establishing a permanent moratorium on new lagoon construction and developed a lagoon conversion program to provide cost-share assistance to producers to voluntarily convert conventional lagoon and spray field systems to innovative animal waste management systems. The program supports new technologies that produce marketable byproducts, reduce or eliminate the emission of ammonia and greenhouse gases, and are capable of being connected to a centralized waste collection and treatment system.

The Cayuga County Soil and Water Conservation District in Auburn, New York, works daily with CAFOs on multiple projects including best management practices, bunk silos, manure storage and transfer systems, milk house waste reduction, barnyard runoff, crop planning and erosion control. The district educates farmers about conservation tactics and efficient agricultural techniques.

The most ambitious of the district's projects has been the construction of a community methane biodigester. The biodigester will centralize manure collection from three local CAFOs.

As these examples demonstrate, each State or local conservation district may take a slightly different approach to addressing local environmental concerns, but there is a consistent theme of working with landowners, providing technical assistance and financial assistance and expertise to help them improve their operations and practices. These changes are critical to our success.

Conservation districts across the Country have been working with landowners for over 70 years and will continue to seek solutions that benefit our communities and protect natural resources. We believe that flexibility should be built into Federal programs and requirements to allow States to buildupon their own successful efforts. NACD and our members will continue to work with landowners to ensure the protection of our natural resources.

Madam Chair and members of the Committee, thank you very much for the opportunity to testify today, and I am more than willing to answer any of your questions.

Thank you.

[The prepared statement of Mr. Sims follows:]

STATEMENT OF OLIN SIMS, PRESIDENT, NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS

Good morning, I am Olin Sims, President of the National Association of Conservation Districts (NACD) and a rancher from McFadden, Wyoming. On my family operation, the Sims Cattle Company in the Rock Creek Valley, we run a 700 cow/calf operation on 22,000 acres of deeded, private, State and Federal leases in southern Wyoming. The ranch retains ownership of all calves and feeds to finish in Nebraska.

I was first elected to my local Conservation District, Medicine Bow Conservation District, as a Rural Supervisor in 1987 and have served as an area director since 1996. As a national officer of NACD I am required to maintain my local elected position in Wyoming. Conservation Districts across the country are led by Boards that have been locally elected or appointed by State officials. We represent members of the community, landowners, farmers, ranchers, businessmen and women or anyone that has a keen interest in the protection of natural resources in their local community.

Across the United States, nearly 3,000 conservation districts are helping local people to conserve land, water, forests, wildlife and related natural resources. We share a single mission: to coordinate assistance from all available sources—public and private, local, State and Federal—in an effort to develop locally driven solutions to natural resource concerns. More than 17,000 members serve in elected or appointed positions on conservation districts' governing boards. Working directly with more than 2.3 million cooperating land managers nationwide, their efforts touch more than 1.5 billion acres of private forest, range and crop land. NACD believes that every acre counts in the adoption of conservation practices. We work with landowners across the country—urban, rural, row crop farmers, ranchers, forestland owners and specialty crop producers on the plains, in the hills and on both coasts—so we know that no one program, practice, or policy will work for everyone. We support voluntary, incentive-based programs that present a range of options, providing both financial and technical assistance to guide landowners in the adoption of conservation practices, improving soil, air and water quality and providing habitat and enhanced land management.

Established under State law, conservation districts are local units of State Government charged with carrying out programs for the protection and management of natural resources at the local level. Our members work with the U.S. Department of Agriculture's Natural Resources Conservation Service(NRCS) as well as State and county programs to assist livestock producers in developing, understanding, and implementing the terms of their individual nutrient management plans . Each State may address the needs of livestock producers a little differently and included in my testimony are a few examples of what local Conservation Districts are doing across the country.

LOCALLY LED CONSERVATION

Local county-level Conservation Districts assist in the implementation of Federal conservation programs, working with the USDA's NRCS and the Farm Service Agency (FSA). Our members see the benefits of appropriate technical assistance and offering financial assistance when working with private landowners. As members of our local communities, our neighbors frequently want to take the correct action, but need the technical information to know what those actions may be, the education and training to be able to apply new practices and requirements to their operations and in some cases financial assistance to make a change in an agriculture operation.

The major Farm Bill program that assists livestock producers is the Environmental Quality Incentives Program (EQIP). EQIP provides cost-share funding (generally 50 percent Federal, 50 percent from landowner) for specific systems and practices, construction, and the development of Comprehensive Nutrient Management Plans(CNMPs). Conservation districts assist in gathering local input and priorities for these programs, addressing the most pressing natural resource issues within the state. Livestock producers in all states can apply for assistance under EQIP.

Several states have also entered into agreements with FSA and identified watershed and water bodies that would benefit from a Federal/State partnership under the Conservation Reserve Enhancement Program (CREP). While this program focuses on buffer strips, filter strips and retirement of certain acreage from production and does not specifically address livestock operations, it is utilized to focus broader efforts for water quality improvements and leveraging State and Federal funds.

EPA's 319 Non Point Source Grant Program is frequently utilized in states to address concerns on animal feeding operations. Several Conservation Districts or State Associations receive these grants to assist livestock producers (non CAFOs) on proper management of their operations and protecting water quality.

Conservation Technical Assistance is considered the backbone for these Federal programs as well as State and local programs. Technical Assistance is the individualized guidance and information that helps a landowner make a change. It could be engineering design work, assistance from an agronomist or localized information for soil types, habitat, nutrient reduction strategies and know-how for application of conservation practices and structures or the development and implementation of nutrient management plans.

CAFO REGULATIONS

NACD provided comments to EPA on their CAFO regulations on several occasions. In our written comments to the agency, NACD expressed support for the elimination of duty to apply requirement for all CAFOs. NACD supports EPA's proposal for the revised regulation that would require only those CAFOs that discharge or propose to discharge to apply for aNational Pollutant Discharge Elimination System (NPDES) permit.

NACD agrees with including CNMPs as a component of NPDES permits for CAFOs. We also agree that associated production and/or land application areas, as defined in the proposed regulation, should be included within the permit only for the CAFO permitee. It should not include offsite application of CAFO-generated wastes. In modifying a nutrient management plan, we support allowing the operation to modify implementation and report modifications to the permitting authority while not requiring public review. An operator must have flexibility in meeting the goals of the nutrient management plan providing for some alteration in cropping and practices as appropriate for their operation.

NACD also supported the action by EPA this summer to extend the compliance deadline for obtaining a comprehensive nutrient management plan. As you will note from our specific State examples, Conservation Districts and individual producers are actively working on developing and implementing comprehensive nutrient management plans. While this work is underway, we did not see that it would have been possible to meet the July 31, 2007 deadline and therefore we support the extension to February 27, 2009.

With regard to unpermitted large CAFOs and AFOs not required to obtain permits, we would encourage all operators to work with voluntary conservation programs and their local conservation districts to determine the conservation practices that best suit their specific operations. Landowners are frequently seeking assistance in applying conservation practices, but are limited by the technical knowledge to implement these practices correctly.

Conservation Districts are actively working with livestock producers with various sizes of operations. NACD is facilitating information between our states and individual districts to share success stories and information. We are pleased to provide the committee with several examples of outreach and implementation efforts from across the country.

STATE EXAMPLES

In my home state, the Wyoming Association of Conservation Districts, in cooperation with the Wyoming Department of Agriculture, Wyoming Department Environmental Quality (DEQ), NRCS and livestock industry in Wyoming, initiated an Animal Feeding Operation/Confined Animal Feeding Operation Program in 1997.

The effort was implemented from 1997 ? 2001 with projects continuing to be implemented to date. Educational efforts were funded in part utilizing Clean Water Act section 319 funds. The goals of this effort were to 1) Inform and educate livestock producers on potential impacts of AFO's on water quality/resource conditions and also an understanding of Federal/State regulatory requirements 2) establish demonstration projects to further awareness and 3) to provide the necessary cost-share and technical assistance to Wyoming livestock industry.

The first 2 years of the program the primary focus was aimed at elevating the level of awareness within the livestock industry on Federal regulatory requirements through the development of a educational brochure which was distributed to 3,000 livestock producers (producers owning 200 head of livestock or more) and the development and distribution of a self-assessment for producers to utilize to determine their risk. Over 22 educational workshops were held throughout the State with more than 1,250 livestock producers attending.

A cooperative agreement was also developed with NRCS which dedicated two field staff to providing dedicated assistance to producers to assess their operations and develop plans for modifications if necessary.

Approximately 15 demonstrationsites on animal feeding operations were implemented throughout the State on animal feeding operations program that had "unacceptable conditions" as defined by the Federal regulations. Tours were conducted of the sites after completion.

In addition, due to the high demand from livestock producers to address unacceptable conditions on AFO's, NRCS dedicated $225,000 at the State level in EQIP funds to specifically meet the need for AFO cost share. Wyoming also sought additional funds from the national level and received $105,000 through NRCS to add additional technical assistance to meet the demand. After the educational efforts were conducted, a huge increase in assistance was experienced by NRCS and folks in some areas were put on a waiting list.

In addition, the local conservation districts through their water quality improvement efforts have continued to fund a number of animal feeding operation projects as part of efforts to address impairments on surface waters within the state. Funding for these are typically from a variety of sources including producers, local funds, CWA 319 and/or EQIP funds. All districts that have waters listed on the state's 303(d) list as being impaired due to bacteria (E. Coli) have local programs to assist producers within these watersheds to address their operations if unacceptable or contributing conditions exist.

NRCS reports that in 2006 an additional 21 projects and in 2007, 28 projects were funded through the statewide EQIP set aside fund.

Regarding Concentrated Animal Feeding Operations, in Wyoming all CAFO's (based on the size threshold) are required to obtain a NPDES permit from Wyoming DEQ. DEQ started requiring that the permit include the nutrient management plan prior to the final adoption of the EPA regulatory revisions. There are 63 CAFO permits issued in Wyoming.

In New Mexico, the New Mexico Association of Conservation Districts worked to ensure that conservation programs made sense for the dairy operations within their state. After initial concern about a process that was too complicated the Association worked to ensure dairy producers could utilize conservation assistance programs. Today, the State Technical Committee that establishes priorities for the implementation of USDA Farm Bill Conservation programs at the State level sets aside EQIP funding to assist CAFOs in developing CNMPs. The Association has also worked to obtain State funds for additional technical assistance to CAFOs. The Association has been able to contract with retired NRCS employees to provide additional resources to develop CNMPs.

The South Dakota Association of Conservation Districts and member districts work on several outreach and implementation efforts with livestock operators within the state. For animal feeding operations, the Association provides, through an EPA 319 nonpoint pollution grant, cost-share to design nutrient management systems in targeted watersheds to meet Total Maximum Daily Loads (TMDL) goals. Under this grant, the Association staff work with the producer from initial contact through full implementation. The producer pays 25 percent of the cost of the engineer to design the system with 319 funding providing the other 75 percent. Once the design work is complete, the Association staff helps the producer apply through EQIP or local watershed projects for cost-share assistance for any needed construction assistance such as sediment ponds, lagoons, vegetated treatment areas, etc. To date, 69 producers are involved in the program.

South Dakota's work on existing CAFOsincludes an agreement with NRCS to provide technical assistance to producers to implement their nutrient management plans. Once a CNMP is complete, a producer frequently needs assistance with the requirements of the plan, and guidance on the maintenance of their operation to comply with the plan. Agronomists help to ensure continued proper application rates of nitrogen and phosphorus. Producers are taught how to correctly obtain a soil sample, a water sample, and a manure sample and how to interpret the results so that they can correctly apply the required amounts. The Association's employees have taught producers how to calibrate their application equipment ? including using portable scales so that producers can weigh their manure spreaders and find out how much they really hold.

On an annual basis, the Association staff sits down with the producer and re-evaluates their plan so that they can see how well it is working or what they may need to do differently. This really helps when the producer is using rented land for application—sometimes they don't keep the lease and then they need to re-work their application plans for new land. The goal is that, after a few years, the producer gains the technical skills to manage his own CNMP. The Association has learned that they are asking the producers to adopt a whole new way of doing things and that requires transfer of technical knowledge. They don't expect producers to be able to learn it on their own because it can be overwhelming.

CAFO operators can also seek financial assistance for development of CNMPs and construction cost-share through the EQIP programs.

In Minnesota, Conservation Districts play an important role as an intermediary between producers and communities where CAFOs are proposed. Districts are often called upon to provide hearings for public comments when establishment of a CAFO is being considered. The district can help to vet issues raised by their local community, and can also provide information to the community on the environmental impact of proposed CAFOs. This service as a moderator ensures that dialog is established between public and private interests during CAFO planning phases.

Minnesota districts also assist CAFOs with different approaches ensuring proper nutrient management. They can serve as a bridge between CAFOs and NRCS when operators wish to apply for Federal assistance through programs such as EQIP. Districts also facilitate and promote EQIP opportunities for operators, and provide assistance to operators interested in applying for EQIP. Finally, Districts promote creation of nutrient management plans in TMDL areas and Well Head Protection Areas, and encourage CAFO operators with existing NMPs to meet with Certified Crop Advisors to revisit their plan and make sure its provisions are current with soil conditions.

In Oklahoma the Conservation Commission has taken the lead on two different watershed projects addressing water pollution. In cooperation with Federal State and local partners, these projects resulted in improved water quality. The Peacheater Non Point Source National Monitoring Program Project included the Adair and Cherokee County Conservation Districts, NRCS, USGS, EPA, Oklahoma State University Extension, and the Oklahoma Scenic Rivers Commission. This project was funded through a 319 grant to work with landowners to implement riparian management, buffer and filter strips, composters and animal waste storage facilities, improved pasture management and septic systems. Through the installation of BMPs, the phosphorus loading to Preacheater Creek was reduced by 69 percent.

A similar project was conducted on the Eucha/Spavinaw Watershed where 319 funds, State priority watershed funds and individual landowner funds were used on a locally led effort. A Local Watershed Advisory Group was established to recommend BMPs and cost-share rates. The program included the Delaware County Conservation District in Oklahoma and the Benton County Conservation District in Arkansas, as well as the city of Tulsa, USGS, NRCS, EPA, Oklahoma State University Extension, and the Arkansas Soil and Water Conservation Commission. The project included riparian management, buffer and filter strips, streambank stabilization, composters and animal storage facilities, pasture establishment and management, proper waste utilization and septic systems. The project resulted in a 31 percent decrease in phosphorus loading to Beaty Creek in the Eucha/Spavinaw Watershed.

This area in the Eucha/Spavinow Watershed is also an EQIP priority area and this past spring became a CREP area. The primary objectives of the Oklahoma CREP are to install field buffers to trap sediment, nutrients and bacteria; reduce sediment loading by up to 3,702 tons, phosphorus loading by up to 19,825 pounds and nitrogen loading by up to 191,887 pounds annually. These goals are to be achieved by voluntary enrollment in 14 or 15 year Conservation Reserve Program contracts and 15 year or permanent State easements, as well as enrolling adjacent non-CREP riparian acreage into a State incentives program (FSA CREP fact sheet). Oklahoma has a variety of voluntary conservation programs working together to address nutrient and sediment loading to improve water quality as well as improving wildlife habitat.

Thanks to a proactive approach to working with poultry producers in Texas, most poultry facilities were already in compliance with EPA when they recently made changes that defined larger dry-litter operations as CAFO's.

Soil and Water Conservation Districts in Texas have been working with the State for several years to assist poultry facilities to comply with State laws. All operations in Texas are required to have a Water Quality Management Plan, which is equivalent to a CNMP.

These CNMPs included virtually all of the technical components of a CAFO permit under the EPA NPDES Permitting Program; consequently, the industry was well prepared for the EPA regulation changes. Soil and Water Conservation Districts in Texas provide the technical and financial assistance to develop and implement these CNMPs so they comply with Federal and State CAFO regulations.

The districts employ technical service providers to develop the CNMPs and assist producers with the installation. Local districts also provide state-appropriated cost share funding. District employees also work with the poultry operations to "maintain" the implemented status of CNMPs through annual status reviews and by providing soil sampling services.

Soil and Water Conservation Districts in North Carolina in partnership with the state's Soil and Water Conservation Commission, have led an aggressive and proactive approach to dealing with the state's major livestock and poultry industries.

In 1983 the North Carolina General Assembly authorized the NC Agriculture Cost Share Program to improve water quality associated with agriculture in three nutrient sensitive areas that covered 16 counties. The program was expanded in 1990 to include 96 Soil and Water Conservation Districts covering all 100 counties.

The program provides 75 percent cost share for producers to implement resource management practices and encouraged the use of new and emerging technologies. Highlights of the program include the installation of 3559 waste management structures to properly store and manage dry and wet animal waste; the installation of 815 mortality management systems to properly manage livestock mortalities to minimize water quality impacts; and the placement of over 950 miles of fencing in combination with other practices to exclude livestock from streams.

While the program addresses a range of agriculture-related water quality issues, 2500 permitted facilities are often a focus of the activities. Approximately $58.1 million (38 percent) of the funds have been directed to CAFOs and AFOs.

According the program's recent annual report, the program is delivered locally by 494 elected and appointed Soil and Water Conservation District supervisors and by over 400 local staff of districts and Federal partners. District supervisors are responsible for seeing that State funds are spent where they are most needed to improve water quality. District supervisors are required to develop a prioritization ranking system for administering the program in their respective districts to maximize the benefits to the state's water quality goals. Applications are evaluated and prioritized by the District and Districts are required to inspect at least 5 percent of the contracts annually.

The cost share program is not the only activity in NC to help better manage livestock and poultry operations. In 1993, the NC State government established a non-discharge rule requiring all farms meeting the following threshold numbers to register with the appropriate State agency and to secure a certified animal waste management plan by 1997. The size requirements are as follows:

250 swine (55 pounds or greater)
100 or more confined cattle
75 horses
1,000 sheep
30,000 confined poultry with liquid waste system

These plans must be certified by a technical specialist designated by the NC Soil and Water Conservation Commission. The technical specialists are often conservation district employees. These requirements became a part of the State and NPDES permitting process in 1996.

In 1999, in the wake of flooding devastation from Hurricanes Dennis, Floyd, and Irene, the State initiated a buyout program for active swine operations in the 100-year floodplain. The State has invested over $16 million to operate this program to date, and has removed 39 swine operations from harm's way in the floodplain. Another grant of $3 million has just been approved to continue this popular and highly successful flood hazard mitigation program with the expectation that another 6–7 high-priority operations will be included. Participating operations must agree to allow a conservation easement on the property to prevent future CAFO operation on the property and to prevent development of the property for non-agricultural uses.

Just this year, NC passed legislation that established a permanent moratorium on the construction of new lagoons and a new Lagoon Conversion Program where producers can receive cost share assistance to voluntarily convert from conventional lagoon and spray field systems to "approved" innovative animal waste management systems. The program supports systems that produce marketable by products, reduce or eliminate the emission of ammonia and greenhouse gases, and are capable of being connected to a centralized waste collection and treatment.

The NC Soil and Water Conservation Commission and conservation districts will be involved in the development and implementation of this exciting new initiative.

As you can see, communication and collaboration among interested parties have established exciting programs and policies in NC. In many cases the success of the programs can be tied to a goal of locally led programs with involvement and support of conservation districts.

The Sussex Conservation District in Delaware has four conservation planners on staff funded through a Nonpoint Source Pollution Section 319 Grant and the State of Delaware. These planners are funded to provide nutrient management plans to Sussex County landowners.

Upon request, the Sussex Conservation District provides producers with technical and financial assistance. A conservation planner visits the farm to assess their resource concerns and provide the farmer with a comprehensive nutrient management plan. The District also provides financial assistance through a cost-share program for BMPs that address water quality issues. Some of the BMPs that the District provides cost-share assistance are poultry manure structures, poultry carcass composters, poultry incinerators, poultry windbreaks, animal waste systems, heavy use area protections (concrete pads at the ends of chicken houses or manure structures), and cover crops. With the District's cost-share program, structural BMPs have to be ranked because we always get more requests for funds than we have cost-share money.

The District also administers a 3 percent low interest Agricultural Nonpoint Source loan program that allows farmers to finance, at a low rate, their portion of BMPs that is not covered through cost-share. The normal cost-share rate for BMPs is 75 percent meaning that the farmer must come up with the remaining 25 percent. For example, they can also use the 3 percent loan to purchase a front-end loader for their composting operation or a calibratable manure spreader.

The District also works closely with the Delaware Nutrient Management Program. Delaware's program, which was established with the passing of the Nutrient Management Law in 1999, mandates all landowners with 10 or more acres or 8 animal units be required to have a nutrient management plan by 2007. We are proud to say that the Sussex Conservation District assisted the Delaware Nutrient Management Program in meeting this goal.

If there is conservation or nutrient management concerns on a farm, the District staff may accompany the representatives from the Nutrient Management Program to the farm to discuss alternatives or solutions to whatever issues the farmer is facing. The Delaware Nutrient Management Program also offers cost-share assistance to poultry operators for manure relocation and nutrient management planning. The manure relocation program takes manure from farms that have excess manure and ships it to farms that need the manure or for alternative uses. The cost-share is used to cover the transportation costs. In western Sussex County, there is a manure pelletizing plant that manufactures and packages pelletized manure to be sold to retail locations for fertilizer.

The Cayuga County Soil and Water Conservation District in Auburn, New York has had many beneficial interactions with CAFOs in Cayuga County. The District has about half a dozen conservation professionals that work regularly with CAFOs on multiple projects including:BMPs, bunk silos, manure storage and transfer systems, milk house waste reduction, barn yard runoff, crop planning and erosion control. The District has worked extensively with farmers to educate them about conservation tactics, and efficient agricultural techniques. The nutrient management specialists have worked to lower the environmental impacts of manure waste on the community and environment. The District has been involved with vermacomposting, drag hose application; manure additives and wind powered manure agitators all of which limit CAFOs waste problems.

The most ambitious of the District's projects has been the construction of a Community Methane Biodigester. The Biodigester will centralize manure collection from 3 local CAFOs on the District's campus. The manure, along with food waste, will be anaerobically digested to create "environmentally friendly" biogas, liquid fertilizer and solid compost. The Biodigester will address nutrient runoff and loading problems in the Finger Lakes. The Biodigester will make the liquid fertilizer much more nutrient balanced for reapplication to the farm fields, while removing the solid, nutrient rich, compost out of the watershed by selling it separately to gardeners and nurseries. The Biodigester will also eliminate pathogens and odor caused by the spread of manure and that make community relations difficult for CAFOs.

At a recent NACD Northeast Region meeting, a Conservation District shared a proactive approach in working with CAFOs. The district realized that in the event of an agriculture emergency such as a manure spill, they could provide assistance both to the operator and to emergency management personnel who would respond by serving in an advisory capacity.

To that end, the district has established a relationship with 911 officials and local fire departments so that they are aware of agriculture related emergencies and how to respond. As a result, the local 911 center created a data base of resources to utilize for agriculture emergencies, including the local conservation district. The district has also provided outreach to local CAFO operators to provide instruction on how to develop agriculture emergency plans and procedures for contacting authorities in the event of an agriculture emergency. In doing so, the district is also helping CAFO operators stay in compliance with regulations, which require notification in the event of an emergency.

As these examples demonstrate, each State or local conservation district may take a slightly different approach to addressing environmental concerns in the local area. We have provided only a few examples, but most states have similar efforts and Conservation Districts across the country are assisting in the delivery on Farm Bill Conservation Programs, prioritizing local projects and natural resource issues within the state. Each State may take a different approach, but there is a consistent theme of working with landowners, providing technical assistance, financial assistance and expertise to help them make changes to their operations, or alter practices that is critical to our success. Conservation Districts across the country have been working with landowners for 70 years, and we will continue to seek solutions that benefit our communities and protect natural resources. Proactively working with landowners, educating, teaching and providing useful information, expertise and guidance is critical to the success of our efforts. We believe that flexibility should be built into Federal programs and requirements to allow states to buildupon their own successful efforts. NACD and our member State associations and individual districts look forward to continuing to work with landowners to ensure the protection of our natural resources.

Senator BOXER. Thank you very much, sir.

We next turn to Thomas Bonacquisti, Water Quality Program Manager, Loudoun County Sanitation Authority, Association of Metropolitan Water Agencies.

Welcome, sir.

STATEMENT OF THOMAS P. BONACQUISTI, WATER QUALITY PROGRAM MANAGER, LOUDOUN COUNTY SANITATION AUTHORITY, VA, AND ASSOCIATION OF METROPOLITAN WATER AGENCIES

Mr. BONACQUISTI. Good morning, Madam Chairwoman, Senator Inhofe and distinguished members of the Committee.

My name is Tom Bonacquisti, and I am currently the Water Quality Program Manager with the Loudoun County Sanitation Authority which serves drinking water and provides wastewater services to 175,000 people in eastern Loudoun County, Virginia. Previously, I worked as the Director of Water Quality and Production for the Fairfax County Water Authority also located in northern Virginia.

Today, I am here on behalf of the Association of Metropolitan Water Agencies or AMWA, which is an organization of the largest publicly owned drinking water providers in the United States. AMWA's members provide clean and safe drinking water to more 127 million Americans from Alaska to Puerto Rico.

AMWA commends you for holding this hearing to investigate the impact of concentrated animal feeding operations on regional water quality and safety and appreciates the opportunity to present its views on this important and timely issue.

Thirty-five years ago this fall, Congress passed the Clean Water Act, landmark legislation that has greatly reduced the discharge of harmful pollutants into the Nation's waters and enabled their continued use as drinking water supplies.

With the subsequent passage in 1980 of the Comprehensive Environmental Response, Compensation and Liability Act, CERCLA, also known as the Superfund Law, Congress sought not only to strengthen environmental protections but also to ensure that communities were able to recover from polluters the cost of cleaning up toxic and hazardous waste released into the environment.

However, in recent years, the owners and operators of large concentrated animal feeding operations or CAFOs have increasingly advocated in favor of taking steps to exempt themselves from the critical environmental law.

Today, I will discuss the negative impacts that components of animal waste have on America's drinking water supplies and testify that exempting these substances from the requirements of CERCLA would carry significant public health and financial cost for all Americans who depend upon access to clean and safe water.

First, it is important to define what exactly constitutes a CAFO. According to EPA, a CAFO is a large farm that generally holds hundreds of animals such as more than 700 dairy cattle, 1,000 beef cattle, 55,000 turkeys or 30,000 hens for a period of at least 45 days. Clearly, it would be difficult to confuse a large industrial CAFO with a small family farm which generally holds far fewer animals and, as a result, has much less of an impact on the surrounding environment.

Over the past several decades, the number of corporate CAFOs in the United States has steadily increased while the number of small farms has declined and, as a result, today it is estimated that 54 percent of U.S. livestock are held on CAFOs, representing only 5 percent of livestock farms.

These CAFOs alone generate approximately 570 billion pounds of animal waste per year. Because such a large volume of waste is generated each day at CAFOs, it is rarely economically feasible to have animal manure hauled away. As a result, the waste is usually stored in onsite lagoons until it is applied to fields as fertilizer.

There are several problems with this process including poor maintenance of lagoons that will allow the waste to leach into the ground and surrounding water supply. For example, a study in Iowa found that more than half of the State's 5,600 agricultural manure storage facilities consistently leaked in excess of legal limits, thereby allowing CERCLA-regulated contaminants commonly found in manure, such as nitrogen and phosphorus, to run off into the watershed.

The increasing prevalence of such contaminants in drinking water contributed to EPA's finding in 2000 that agriculture is the leading contributor to State-reported water quality impairments with 29 States identifying livestock feeding operations as a source of such impairments.

One of the most common drinking water quality problems related to animal manure is the increasing level of algae that grows in water supplies when phosphorus or nitrates are present. When too much a nutrient, such as phosphorus, is added to a reservoir, it stimulates plant algae and bacterial growth, leading to serious taste and odor problems.

Senator BOXER. Sir, we have to ask you to finish up.

Mr. BONACQUISTI. OK.

In conclusion, public drinking water systems have a duty to do all that they can to ensure that the water they deliver to their customers is clean and safe. Likewise, CERCLA, with its polluter pays principle, offers assistance to communities forced to clean up the mess.

Senator BOXER. Sir, I am sorry. Our problem is, sir, we have just been told that the cloakroom is not going to postpone this vote. So the vote is actually going to start at 11:05.

Mr. BONACQUISTI. Thank you.

[The prepared statement of Mr. Bonacquisti follows:]

STATEMENT OF THOMAS P. BONACQUISTI, WATER QUALITY PROGRAM MANAGER, LOUDOUN COUNTY SANITATION AUTHORITY, VA, AND ASSOCIATION OF METROPOLITAN WATER AGENCIES

Good morning, Madam Chairwoman, Senator Inhofe and distinguished members of the committee. My name is Tom Bonacquisti, and I am currently the Water Quality Program Manager with the Loudoun County Sanitation Authority, which serves drinking water and provides wastewater services to about 175,000 people in eastern Loudoun County, VA. Previously, I worked as the Director of Water Quality and Production for the Fairfax County Water Authority, also located in Northern Virginia. Today I am here on behalf of the Association of Metropolitan Water Agencies, or "AMWA," which is an organization of the largest publicly owned drinking water providers in the United States. AMWA's members provide clean and safe drinking water to more than 127 million Americans from Alaska to Puerto Rico.

AMWA commends you for taking the opportunity offered by this hearing to investigate the impact of concentrated animal feeding operations on regional water quality and safety, and appreciates the opportunity to present its view on this important and timely issue.

Thirty-five years ago this fall Congress passed the Clean Water Act, landmark legislation that has greatly reduced the discharge of harmful pollutants into the nation's waters and has helped make them safe for multiple uses, including as drinking water sources. With the subsequent passage in 1980 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund law, Congress sought not only to strengthen environmental protections, but also to ensure that communities were able to recover from polluters the cost of cleaning up toxic and hazardous waste released into the environment. However, in recent years the owners and operators of large concentrated animal feeding operations (CAFOs) have increasingly advocated in favor of exempting themselves from this critical environmental law, by removing manure and its components from CERCLA's jurisdiction. Today, I will testify that providing a blanket exemption for manure from the requirements of CERCLA could damage the quality of drinking water sources that millions of Americans have come to depend upon.

WHAT IS A CAFO?

It is essential to first define what exactly is a "CAFO." Despite the arguments made by some, concentrated animal feeding operations are very different from small family farms. According to the Environmental Protection Agency's 2004 Risk Management Evaluation for Concentrated Animal Feeding Operations, a CAFO is a large farm that generally holds more than 700 dairy cattle, 1,000 beef cattle, 55,000 turkeys, or 30,000 hens (with a liquid manure system) for a period of at least 45 days.[1] On an annual basis, these CAFOs can produce as much waste as a small-to-mid-size American city. Clearly, large operations of this size are not what one thinks of when envisioning a typical family farm.

It must also be clear that small family farms are unlikely to be impacted one way or another by efforts to redefine CERCLA's application to agricultural operations. While some have painted the absence of a CERCLA animal waste exemption as a threat to the existence of family farms in the United States, responsible small farming operations are unlikely to pollute to the extent to which they would be found in violation of the Superfund law. However, the sheer magnitude of animals densely held in CAFOs cause such operations to have a far more serious impact on the surrounding environment and water quality. It is estimated that 54 percent of U.S.

[1]EPA, Risk Management Evaluation for Concentrated Animal Feeding Operations, EPA/600/R–04/042 at 3–1 (May 2004) ("Risk Management Evaluation"), http://www.epa.gov/nrmrl/pubs/600r04042/600r04042.pdf.

livestock are held on CAFOs representing only 5 percent of livestock farms,[2] which generate approximately 575 billion pounds of animal waste every year.[3]

Contributing to this problem is the growing prevalence of these CAFOs. In 1982 there were more than 1.2 million small farms in America holding fewer than 150 animals, but by 1997 there were only about 920,000, a 26 percent reduction. During the same timeframe, large farms with more than 1,000 head of livestock increased 47 percent, from 5,442 to 8,021. Viewed a different way, over that fifteen-year period the total number of animals on small farms decreased from 45.8 million to 34 million, while the animal population of large farms increased by 58 percent from 15.7 million to 24.9 million.[4] The consequences of this shift are twofold: not only are large corporate-run animal feeding operations rapidly supplanting traditional family farms, but the typical manure disposal practices of CAFOs—which commonly involve holding waste in huge leak-prone cesspools and field application techniques that lead to increased runoff—pose serious dangers to the quality of nearby drinking water supplies. Waste from family farms, on the other hand, is usually generated and released in much smaller volumes, so it is more readily controlled.

CURRENT MANURE REGULATION UNDER CERCLA

As the number of CAFOs in the United States continues to grow, industry representatives have increasingly argued that they deserve an exemption from pollution cleanup liability under CERCLA. Legislation has been introduced in both houses of Congress that would specifically exclude manure and its components from the law's definition of a "hazardous substance" under section 101(14) and from the definition of a "pollutant or contaminant" under section 101(33). These proposals ignore the facts about CAFOs, CERCLA and animal manure in favor of giving large industrial farms the freedom to release regulated contaminants into the environment without consequence.

Most importantly, it must be noted that under current law, animal manure itself is not considered a hazardous substance, pollutant or contaminant under CERCLA. Arguments from the farm industry that environmentalists are seeking to place animal manure in the same broad category as industrial waste are simply false. However, several toxins frequently found in waste emissions from CAFOs are regulated as hazardous substances under CERCLA, including phosphorus, nitrates, ammonia and even arsenic. Because a dangerous toxin remains a dangerous toxin whether it is released into the environment alone or as a component of another substance, it would be a mistake for Congress to relieve CAFOs of Superfund liability for each and every chemical and substance that may be found in animal manure. When deposited into the drinking water supply, community water systems must take additional treatment steps to remove these toxins and keep the water potable, regardless of their original source. If water systems were unable to recover excessive costs from polluters, all the citizens of the community would see their water rates increase just to maintain their previous level of drinking water quality, an outcome that is unfair and in direct conflict with the Superfund law's "polluter pays" philosophy.

Furthermore, some have argued that the Superfund law could enable the government to prohibit farms from spreading manure-based fertilizers on their fields. This is plainly false. In fact, CERCLA already excludes liability for pollution related to the "normal application of fertilizer." However, cost recovery is permitted against a CAFO that wrongly uses fertilizer as a way to dispose of waste in an attempt to avoid the law. This is a fair, common sense approach that prevents CAFOs from abusing the law, and therefore should not be tampered with.

THE IMPACT OF CAFOS ON WATER QUALITY

For a number of years there have been cases of components of untreated manure from CAFOs having harmful effects on public drinking water supplies across the country. For example, in 2000 EPA's National Water Quality Report to Congress identified agriculture as the leading contributor to state-reported water quality im-

[2] Gollehon N, Caswell M, Ribaudo M, Kellogg R, Lander C, Letson D (June 2001), Confined Animal Production and Manure Nutrients, Economic Research Service, U.S. Department of Agriculture, Agricultural Information Bulletin No. 771, http://www.ers.usda.gov/publications/aib771/ .

[3] U.S. Department of Agriculture, Agricultural Research Service, Manure and Byproduct Utilization: National Program Annual Report: fiscal year 1, www.nps.ars.usda.gov/programs/programs.htm?npnumber=206&docid=1076.

[4] Risk Management Evaluation at 3–1.

pairments, with twenty-nine states identifying livestock feeding operations as a major source of water impairments.[5] EPA has also reported that the sources of drinking water for 43 percent of the U.S. population have suffered some level of pathogen contamination related to CAFOs.[6]

As I previously mentioned, CAFOs typically dispose of their animal manure first by storing it in large lagoons, usually close by where the animals are kept. But because such a large volume of waste is generated each day at CAFOs, it is rarely economically feasible for a CAFO to have animal manure hauled away. As a result, the waste usually stays stored in onsite lagoons until it is applied to fields as fertilizer. There are several problems with this process. First, many manure lagoons are poorly maintained, and allow the waste to leach into the ground and surrounding water supply. For example, a study in Iowa found that more than half of the state's 5,600 agricultural manure storage facilities consistently leaked in excess of legal limits.[7] Even when applied to fields as fertilizer, many CAFOs are not large enough to absorb the massive amounts of nutrients contained in the manure. As a result, CERCLA-regulated contaminants included in manure, such as nitrogen and phosphorus, often runoff into the watershed and adversely impact the water supply.

One of the most common drinking water quality problems related to animal manure is the increasing levels of algae that grow in water supplies when phosphorus—a common manure component and a CERCLA-regulated hazardous substance—enters the water supply. When too much of a nutrient such as phosphorus is present in a reservoir, it stimulates plant, algae, and bacterial growth. If left untreated this increased algae causes serious taste and odor problems with the water, making it unfit for human consumption. To counter this problem water utilities must undertake additional treatments to combat the algae, but the effectiveness of these treatments tend to diminish over a long period of time if nutrients continue to be added to drinking water sources. What's more, increased treatment made necessary by high levels of nutrients in water sources also contribute to the formation of disinfection byproducts that result from the reaction of natural organic matter with disinfectants such as chlorine, ozone, chlorine dioxide and chloramines. The entry of these disinfection byproducts into the water supply can be largely avoided if excessive nutrients are not deposited into drinking water sources in the first place.

Finally, these additional disinfection measures are a sustained cost that water systems and ratepayers should be entitled to recoup from polluters—for the dual purpose of keeping costs under control and encouraging responsible environmental stewardship on the part of agricultural producers.

Some recent examples of CAFO-related drinking water pollution include:

- Des Moines, Iowa

The Des Moines Water Works supplies drinking water to approximately 350,000 people in 4 counties and 23 communities in Central Iowa. In 1991 it constructed the world's largest nitrate removal system (at a cost of $3.7 million to the utility) to clean water from the Raccoon and Des Moines Rivers. The plant costs approximately $3,000 a day when in use, and on average must operate between 45 and 60 days per year in response to upriver manure releases. Nitrate is a common component of animal manure and is also on the list of contaminants regulated by CERCLA.

- Oshkosh, Wisconsin

The city of Oshkosh spends an extra $30,000 a year on copper sulfate treatment to kill algae in drinking water supplies from Lake Winnebago, which are attributed to excess nutrients like phosphorus from manure and other sources. In 2004, there were 59 reported incidents of manure polluting water in Wisconsin, although the State says that the actual number was likely greater.

- Illinois River, Oklahoma

The Illinois River, which flows through Arkansas and into Oklahoma, is the source of 22 public drinking water systems. But Arkansas's Illinois River watershed has one of the nation's densest poultry operations, producing waste equal to 10.7 million people, greater than the combined populations of Arkansas, Kansas and Oklahoma. After 4 years of attempted negotiations and mediation with the industry, the State of Oklahoma sued 14 corporate poultry operations for polluting the Illinois River and the Tenkiller Lake.

- Chino Basin, CA

[5] EPA, "National Water Quality Inventory, 2000 Report" (August 2002) EPA–841-R–02–001, http://www.epa.gov/305b/2000report/

[6] Risk Management Evaluation at 4–2.

[7] Simpkins WW, Burkart MR, Helmke MF, et al. (2002) Potential impact of waste storage structures on water resources in Iowa. J Am Water Resources Assoc. 38:759—771.

The Chino Basin is the supply of drinking water for Orange County. In 1988, 40 percent of the wells in the basin had nitrate levels above drinking water standards. EPA found that dairies were a major cause of the nitrogen, which is a CERCLA-regulated hazardous substance. Removing these nitrates costs more than $1 million per year. Chino also removes more than 1,500 tons of salt per year, which comes from local dairies, at a cost of $320 to $690 for every ton.

• Waco, Texas

Lake Waco supplies drinking water to 150,000 people. Dairy cows in CAFOs upstream from Lake Waco created 5.7 million pounds of manure per day that was over-applied to land and made its way into the lake. The State found that nearly 90 percent of the controllable phosphorus in the river came from CAFOs in the watershed, and an independent researcher who conducted much of the state's analysis found that dairy waste applied to fields supplied up to 44 percent of the lake's phosphorus. From 1995 to 2005, the city spent $3.5 million on phosphorus-related water pollution, and has spent a total of approximately $70 million to improve water treatment. To recoup costs the city filed suit against 14 large industrial dairies in 2003 and eventually reached a settlement with the defendants.

• Tulsa, Oklahoma

The city of Tulsa supplies drinking water to 500,000 people in its metropolitan area, but pollution from poultry farms in Arkansas led to excessive algae growth in Lake Eucha, one of its main water sources. As a result the city spent more than $4 million on increased drinking water treatments to address the problem, and unsuccessfully attempted to negotiate with poultry operations to reduce their manure applications. In 2002, the city sued six major poultry operations and the case was eventually settled, agreeing to a temporary moratorium on the application of litter and the installation of a new drinking water treatment system.

CONCLUSION

When properly managed, the animal waste from agricultural operations can have a minimal impact on their region's water quality. However, this outcome is dependent upon farm operators—particularly those overseeing CAFOs—implementing strong environmental management practices that adequately treat animal waste before releasing it into the surrounding environment. Unfortunately, too many large, corporate-run CAFOs have not implemented these practices on their own, which is why it is so essential for the communities and the public to continue to have recourses available through the Superfund law.

Public drinking water systems have a duty to do all that they can to ensure that the water they deliver to their customers is clean and safe. Likewise, CERCLA, with its "polluter pays" principle offers assistance to communities forced to clean up the mess when CAFOs ignore their responsibility to minimize harmful discharges into the environment. However, providing an entire industry with a waiver to discharge regulated hazardous substances such as phosphorus and nitrates into their region's watershed would result in a more polluted environment and higher costs for community water system ratepayers. As Congress celebrates the thirty-fifth anniversary of the Clean Water Act, such a waiver would turn back the clock to the days of unchecked pollution and declining water quality.

Senator BOXER. Mr. Blackham, Utah Department of Agriculture and Food. We welcome you, sir.

STATEMENT OF LEONARD BLACKHAM, COMMISSIONER, UTAH DEPARTMENT OF AGRICULTURE AND FOOD AND NATIONAL ASSOCIATION OF STATE DEPARTMENTS OF AGRICULTURE

Mr. BLACKHAM. Madam Chairman, members of the Committee, thank you for the opportunity to testify on concentrated animal feeding operations and the environmental issues facing agriculture.

My name is Leonard Blackham. I am the Commissioner Agriculture for the Utah Department of Agriculture and Food.

I appear here today to represent the National Association of State Departments of Agriculture, NASDA. NASDA represents the commissioners, the secretaries and directors of agriculture in 50 States and 4 territories.

We share your commitment to the environment and have a long history of being good stewards of the land by implementing sound conservation practices. States are partners with the Federal Government and the Federal system in protecting the environment. For example, a majority of the 50 States' departments of agriculture have been the lead agency in implementing Federal pesticide laws.

You may be surprised to hear that half of the State conservation agencies are housed within the State departments of agriculture. In this capacity, we oversee and implement soil and water conservation programs, non-point source water quality programs and a variety of other environmental resource programs.

In my State of Utah, we jointly administer the concentrated animal feeding operation program in partnership with the Department of Environmental Quality and with non-governmental partners, all the major commodity groups, Farm Bureau and Utah State Extension.

State agriculture departments have tackled many environmental, water quality, food safety and pesticide issues before they reach the national attention. In part, this is due because we have established a close working relationship with farmers and ranchers and a diverse group of local stakeholders.

In Utah, we have had an amazing success in the CAFO, and I think one of the main reasons is that because when a knock comes on the door, it is either a farm bureau rep, someone from the conservation district or someone from the extension service, knocking on the door. We hear them say there is a little problem here, but we are here to help you, and it is one time when they believe that, that we are here to help. It is far different than if it is an EPA staff member knocking on the door, saying that there is a problem.

State-led initiatives and Farm Bill conservation programs are providing significant and continuing opportunities for major environmental quality protection. Crop and livestock producers are among the most dedicated and effective stewards of our natural resources because agriculture depends upon the continued access of clean water, air and fertile land for its vitality.

USDA conservation programs have increased in addressing water quality issues related to livestock operations. The Environmental Quality Incentives Program, EQIP, provides financial and technical assistance to install and implement conservation practices on working agricultural land. The 2002 Farm Bill, in fact, requires 60 percent of EQIP funds to be targeted toward livestock production in this arena.

EQIP and USDA conservation programs are critical to agriculture because meeting new environmental demands is a make or break challenge for most producers. Many on-farm environmental enhancements are beyond the short term and even long term economic payback for producers. For example, many conservation practices have high capital and management costs but do not generate any additional revenue. Agriculture is not organized in a fashion that allows increased costs to be passed on to the consumer.

We have many State programs, and that is included in the written testimony, and I will skip that. You can look at that.

We have provided you with three examples that report—California, New York and Utah—on the CAFO program. You can read that and see some real success stories that are happening in the Country with those three examples, and many other States have similar success.

NASDA believes in a market-based approach to agriculture environmental protection is more effective. We reach the producers. We provide greater environmental benefits, give States flexibility to address the most critical problems, target resources where most needed on a site-specific basis, increase local buy-in to find workable solutions, emphasize preventive measures which are more cost-effective and offer economic returns, and address the expanding list of emerging problems such as carbon emissions and air quality problems.

A key component of our proposal for the 2007 Farm Bill is a new incentive to address agriculture conservation and natural resource and environmental priorities through a State partnership agreement. We are suggesting a block grant type approach to the departments of agriculture to address these important issues.

A strong livestock——

Senator BOXER. Sir, could you just wrap it up? You have 8 seconds left.

Mr. BLACKHAM. You bet. Thank you.

A strong livestock industry is important to all of us. We all enjoy food. We enjoy cheap food in this Country, and we don't want to do a program that is going to drive our livestock industry outside of this Nation.

We want to protect the environment, and a partnership with the States and with local commodity and organizations and farming is the way to do it.

Thank you.

[The prepared statement of Mr. Blackham follows:]

STATEMENT OF LEONARD BLACKHAM, COMMISSIONER, UTAH DEPARTMENT OF AGRICULTURE AND FOOD AND NATIONAL ASSOCIATION OF STATE DEPARTMENTS OF AGRICULTURE

Mr. Chairman and members of the Committee, thank you for the opportunity to testify on Concentrated Animal Feeding Operations (CAFOs) and environmental issues facing agriculture. My name is Leonard Blackham. I am the Commissioner of the Utah Department of Agriculture and Food, and I appear here today on behalf of the National Association of State Departments of Agriculture (NASDA). NASDA represents the commissioners, secretaries and directors of agriculture in the fifty states and four territories.

We share your commitment to the environment and have a long history of being stewards of the land by implementing sound conservation practices. Today, I would like to broadly outline the important role that State agriculture departments play in environmental protection and describe our efforts and issues related to animal feeding operations. The challenge today is how to maintain an economically viable and healthy agricultural landscape producing the food and fiber on which our country depends, while improving the agricultural environmental benefits our citizens enjoy. Agriculture provides not only the food and fiber of America, but is the largest offset provider against human activity. A healthy agricultural landscape provides clean air, water and open space.

ROLE OF STATE AGRICULTURE DEPARTMENTS

States are partners in the Federal system of environmental protection. For example, a majority of the fifty State departments of agriculture have long been the lead State agencies for implementing Federal pesticide laws. You may be surprised to hear that about half of the State conservation agencies are housed within the State agriculture departments. In this capacity, we oversee and implement soil and water conservation programs, non-point source water quality programs, and a variety of other environmental resource programs. In my State of Utah, we jointly administer the program for Concentrated Animal Feeding Operations (CAFOs) in partnership with the Utah Department of Environmental Quality.

State agriculture departments often tackle environmental, water quality, food safety, and pesticide management issues before they reach national attention. In part, this has occurred because we have established close working partnerships with farmers, ranchers, and a diverse mix of local stakeholders. However, the scope and range of our environmental activities are rapidly expanding. For instance, major initiatives on water quality, including proposals for Total Maximum Daily Loads (TMDLs), Concentrated Animal Feeding Operations (CAFOs), new Clean Air Act standards, and endangered species protection all have a significant impact on agricultural activities and individual farm and ranch operations. Implementing these new and ongoing regulatory activities are placing tremendous demands on State budgets and resources in the technical, financial, educational, and enforcement delivery system.

AGRICULTURAL CONSERVATION OPPORTUNITIES AND ACCOMPLISHMENTS

State-led initiatives and Farm Bill conservation programs have provided significant and continuing opportunities for major environmental quality protection. Crop and livestock producers are among the most dedicated and effective stewards of our natural resources because agriculture depends upon continued access to clean water, air and fertile land for its viability. Many of them have voluntarily adopted environmentally friendly practices that have local, regional, and even global benefits. However, the public is increasingly looking to the agriculture sector to address a growing agenda of environmental issuesincluding nonpoint source pollution and water quality, water shortages, air quality, urban sprawl, animal predation, and invasive species. Other emerging challenges include climate change, carbon emissions, pesticide use, and biodiversity.

USDA conservation programs have increasingly addressed water quality management issues related to livestock operations. The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to install or implement conservation practices on working agricultural land. The 2002 Farm Bill required that sixty percent of EQIP funds be targeted at practices dealing with livestock production. Another important provision requires producers who receive cost-share money to complete a Nutrient Management Plan (NMP) or Comprehensive Nutrient Management Plan (CNMP). The 2002 Farm Bill provided an historic funding increase for EQIP authorizing $6 billion over 6 years, starting with $400 million in fiscal year and increasing to $1.3 billion in fiscal year 6. According to USDA, even with increased levels of funding, requests for EQIP contracts are exceeding available funding by almost six to one.

EQIP and other USDA conservation programs are critical to agriculture because meeting new environmental demands is a "make or break" challenge for producers. Many on-farm environmental enhancements are beyond the short-term and even long-term economic payback for producers. For example, many conservation practices have high capital or management input costs, but do not generate additional revenues. Agriculture is not organized in a fashion that allows increased costs of production to be passed on to consumers. As such, on-farm expenditures for conservation compete directly with servicing farm debt, and other family financial needs. In addition, implementing more stringent and complex standards usually increases the need for more costly approaches and technologies. Farmers are ready to do their part in accomplishing current and future national environmental goals. However, what will be expected of a cattle feeder in North Dakota will be quite different from the challenges faced by a citrus grower in Florida.

Many State departments of agriculture have begun to move on our own to try and fill the gaps in exisiting programs. These initiatives have taken different forms in each region of the country, reflecting State and regional differences both in what our farmers produce and in the most pressing agricultural challenges that they face. For example:

- California began implementing a Dairy Quality Assurance Program (CDQAP) in the late 1990's to promote public health (food safety), animal care and welfare, and environmental stewardship. CDQAP is a partnership of government, educators, and the dairy industry. For example, the environmental stewardship component is designed to assist producers in meeting all Federal, state, regional, and local requirements related to manure management and water quality. The voluntary program provides education about their legal environmental obligations, resources, and funding for the certification of dairy operations.

• New York has developed the highly successful Agricultural Environmental Management (AEM) program. It's principal focus has been to provide direct assistance to farmers with the technical side of nutrient management planning, followed by cost sharing for improvements carried out under plans developed with that technical assistance. The primary environmental goal has been to assure that their dairy farms, which account for more than half of the state's agriculture output, can continue to operate within increasingly stringent water quality regulations.

• Kansas has focused on pesticide management as a key environmental challenge, developing programs to support integrated pest management and establishing Pesticide Management Areas designed to protect surface and groundwater quality.

• The New Jersey Urban Conservation Action Partnership concerns itself with the issues that arise when farming coexists with urban and suburban development.

• Southwestern states are looking at programs that have a large water conservation component.

• Utah has partnered with State agencies, farm organizations, commodity groups and others to achieve an 86 percent succes rate in developing and completing CNMPs for all CAFOs in our State.

Each of these State programs are designed to supplement those that already exist to help farmers carry out their stewardship function and bear the costs of what we see as substantial public benefits: open space conservation, resource preservation for future generations, clean air and water. Each is voluntary, incentive-based rather than sanction-based, designed to address local needs while complimenting existing programs, and carried out in collaboration with all Federal and State agencies already engaged in local environmental management activities.

NASDA believes that such market-based approaches to agricultural environmental protection will be much more effective because they would:

• Reach more producers, thus provide greater environmental benefits overall;
• Give states flexibility to address their most critical problems;
• Target resources to where most needed on a site-specific basis;
• Increase local buy-in to find workable solutions;
• Emphasize preventive measures, which are more cost-effective and offer more economic returns;
• Address the expanding list of emerging problems (i.e. carbon emissions, etc.).

This is a high priority for State departments of agriculture and one of our key proposals for the 2007 Farm

Bill is a bold, new initiative to address agricultural conservation, natural resource and environmental priorities through State partnership agreements. This new Agricultural Stewardship Partnership

Agreement would be a "block-grant" type initiative that would give State and local governments more flexibility, innovative tools, and resources to implement agricultural conservation and environmental priorities.

ANIMAL FEEDING OPERATIONS (CAFOS) AND WASTE MANAGEMENT ISSUES

A strong livestock industry is essential to our Nation's economy, a healthy and high quality food supply, and the viability of our rural communities. Animal Feeding Operations (AFOs) and Concentrated Animal Feeding Operations (CAFOs) present a number of natural resource protection and management challenges. In recent years, animal feeding operations have become increasingly consolidated, specialized, and regionally concentrated.

If properly stored and used, manure from these operations can be a valuable resource. Applying manure to land can be an environmentally sound approach to fertilizing fields. With today's technology, manure can also be used in digesters to produce electricity and other beneficial by-products such as ethanol. If not managed correctly, wastes produced from animal operations can impact the environment and human health. We believe it is important to address waste management issues and water quality impacts in a way that is most appropriate for individual operations affected and which can be implemented with reasonable cost. States and producers need flexibility.

STATE ACTIVITIES AND REGULATION OF ANIMAL FEEDING OPERATIONS

The Environmental Protection Agency (EPA) has been regulating Concentrated Animal Feeding Operations (CAFOs) for more than 25 years. In many cases, the states preceded the Federal Government in both recognizing and regulating issues related to animal feeding operations. Throughout the 1970's, 1980's and 1990's, a number of states set higher or more restrictive standards for CAFOs, usually as a result of local issues or information. Some states developed permit programs and/or required design criteria for protection of both surface water and groundwater. Other states implemented voluntary, incentive-based programs with strategies for nutrient management. These efforts have been led by State agriculture and conservation agencies working together with Federal agencies, livestock and poultry industries, land grant universities, engineering consultants, scientists, and other local stakeholders.

Both State and Federal CAFO rules have been reevaluated and updated over the past several years to keep up with industry changes, new technologies, and public perceptions. EPA finalized new regulations for CAFOs in 2003 which expanded the number of operations covered by the Clean Water Act (CWA) permit program to an estimated 15,500 operations. New permit requirements were added to include comprehensive nutrient management planning, and to extend coverage to include all poultry operations of a certain size. EPA is currently revising its 2003 CAFO rules to conform to a ruling of the 2d Circuit U.S. Court of Appeals in 2005. EPA proposed a revised rule in 2006, but it has not yet been finalized.

NASDA supports EPA's proposed 2006 revised rule. Now, the State agriculture departments and other agricultural stakeholders are anxiously awaiting the agency's final rule. We have urged EPA to limit the final rule to the issues addressed by the court ruling and to provide more clarity on the regulatory obligations of livestock operations. States will need time to modify their CAFO programs to conform with the final rule. In late July, EPA announced that certain compliance deadlines would be extended until February 2009. This is helpful and will allow the states and other stakeholders an opportunity to adjust to the new requirements.

Although states have additional time to implement the new CAFO program requirements, the changes will create a resource and administrative challenge for State agriculture and conservation agencies. EPA has estimated that the CAFO regulations could result in compliance costs of $850 million to $940 million per year.

States will need to increase our efforts to identify, permit and inspect CAFOs. A major challenge is the ability of producers and State agency personnel to prepare the thousands of new nutrient management plans that will be required under the new rule. Livestock operators will need to address multiple nutrients in their waste management plans. They will need additional technical assistance, education, and training to comply with their permits. This creates additional demands on the State agriculture and conservation agencies which provide technical and financial assistance.

The key to achieving the national goal of assuring that animal feeding operations are managed to protect water quality is to provide states with the flexibility and resources to meet legal and programmatic responsibilities. We strongly believe that programs for managing animal nutrients are most appropriately implemented at the State and local level.

OTHER ENVIRONMENTAL CHALLENGES

While environmental improvements are being made, many challenges remain and new issues continue to emerge. NASDA believes there needs to be more recognition, evaluation and research on cross-media impacts from animal feeding operations. CAFOs can affect multiple pollutant media streams—soil, water, air? which could present management challenges or benefits. For example, methane emissions from an animal feeding operation could provide a potential energy source.

Air quality concerns associated with agricultural production include odors, ozone precursors, particulate emissions, and greenhouse gases. More study is needed. Very little science exists for agriculture related air quality issues. In fact, agriculture is currently financing $15 million in research for EPA to help refine air quality issues.

EPA and USDA should develop partnerships with State agriculture departments to address these issues in a voluntary, incentive based way because we will have better success. For example, odor is a local issue. Addressing air quality concerns is an area of increasing emphasis in USDA conservation programs. Livestock producers enrolled in EQIP can receive cost-share assistance for installing anaerobic waste digestors, which significantly reduce odors. The new Conservation Security Program (CSP) provides enhancement payments for action that directly benefits air quality, including improving visability, reducing near-surface ozone levels, reducing transport of fine and course particulates, reducing the potential for airborne agricultural chemicals and volatile organic compounds to affect human health, and increasing the sequestration of carbon on crop, range, and pasturelands.

SUPERFUND REGULATION OF ANIMAL WASTES

Recent lawsuits are threatening livestock and poultry operations by potential liability for emissions or discharges from manure produced or used in their operations.

NASDA strongly believes that it was never intended for agricultural operations and manure to be regulated under the Comprehensive Environmental Recovery, Compensation, and Liability Act (CERCLA) or the Environmental Protection and Community Right-to-Know Act (EPCRA), which are commonly known as Superfund.

We are pleased that EPA has issued guidance to clarify this issue, but urge Congress to pass legislation and confirm that agricultural byproducts produced during routine agricultural operations should not be subject to the provisions of EPCRA and CERCLA. If this clarification is not put into place, farming operations of all sizes could be subject to unwarranted litigation which would negatively impact their operations and the nation's food supply.

Animal agriculture operations and manure managements are already regulated under the Clean Water Act, Clean Air Act, and various State laws to protect the environment. These laws and regulations provide for permitting, enforcement, and if necessary, remediation.

It is important to note that CERCLA/EPCRA clearly exempt the application of chemical fertilizers containing the same constituents as manure—orthophosphate, ammonia, and hydrogen sulfide—which occur naturally in the environment.

This is not a large versus small farm issue. CERCLA/EPCRA current reporting requirements and liability thresholds for non-agricultural releases/emissions of regulated substances are quite low. This means virtually any agricultural operation producing, storing, and/or using animal manure could be held liable under laws. We do not want agriculture to be driven out of business or outside our borders by the heavy hand of government. CERCLA/EPCRA will only divert critical resources away from making agricultural environmental improvements to legal pockets.

STATE SURVEYS ON CONCENTRATED ANIMAL FEEDING OPERATIONS (CAFOS)

NASDA's Research Foundation has been conducting periodic surveys on CAFOs since 1997 with the latest surveys conducted in 2003 and 2005. These surveys were developed to obtain detailed information about State efforts to address water quality concerns, provide an overview of State requirements and regulations, and development of nutrient management plans.

The surveys show that many states have regulations more stringent and/or specific than Federal regulations for CAFOs. Most states have required the development and implementation of a nutrient management plan for the application of manure, while some use a voluntary, incentive-based approach in accordance with sound agricultural practices and agronomic rates. Some states have developed more inclusive individual permit programs and/or required design criteria for protection of both surface water and groundwater. Other states have specified additional surface water protection based on containment structure capacities. A number of states have mandatory training requirements for the operation of a variety of animal operations. In addition to the Federal EQIP cost-share program, many states have their own cost-share programs or a low-interest loan program for best management practices. Most states have required inspections as part of their monitoring and enforcement process.

In 2006, NASDA launched CNMP Watch, a complete web-based source for manure and nutrient management planning information. This website was designed to help producers in preparing NMPs/CNMPs and provide all stakeholders with a portal for information on Federal and State activities. The website address is: www.CNMPWatch.com.

RECOMMENDATIONS

As we have emphasized throughout our testimony, states have already taken a strong lead in working with and regulating animal feeding operations. The Federal Government should capitalize on the proven strengths of the State CAFO programs by providing funding, guidance, and coordination of resources to effectively achieve environmental quality on animal operations. NASDA offers the following recommendations to enhance our capabilities: $ EPA should provide states with the flexibility to account for regional differences in approach and should recognize "functionally equivalent" State programs that meet the National Pollutant Discharge Elimination System (NPDES) goals.

- More coordination is needed between EPA and USDA regarding components of CNMPs, and other forms of nutrient management planning. The CNMP used in the regulatory program as a permit requirement must be the same as the CNMP used voluntarily by non-permitted AFOs. If two different plans are used, the incentive for producers to voluntarily develop CNMPs in hope of avoiding the regulatory program disappears.
- Fully fund the EQIP and Section 319 Nonpoint Source Management Program. NASDA has long believed that the 319 program has been severely underfunded. Under the 319 program, states receive funds to support a wide variety of activities to address nonpoint source water quality issues, including technical assistance, education, training, technology transfer, demonstration projects, and monitoring.
- Provide and fund additional technical assistance from USDA's Natural Resource Conservation Service (NRCS). Thousands of CNMPs are currently waiting for technical support to be completed.
- Provide more research and funding for water quality data and air quality data. Current information and statistics on water quality are lacking in completeness and are dated. Very little science and data currently exists for agricultural air quality issues. More State and Federal funding is needed in these areas to get more accurate, science-based data. This evolving base of knowledge can be used to provide technical assistance and educational assistance to producers. From this knowledge, we also know which management practices and investments should be supported with financial assistance in the form of cost-share payments, loans, and grants.
- Additional research and technology development is needed to better understand cross media issues, such as air quality, odor, greenhouse gases.
- Congress should approve legislation to confirm that agricultural byproducts produced during routine agricultural operations should not be subject to the provisions of EPCRA and CERCLA.

CONCLUSION

One of the most significant trends in the last decade is the growing awareness of nearly all segments of the U.S. society in the importance of preserving our land, water and air resources. Agriculture—like other business sectors—has made substantial investments and taken great strides in protecting the environment.

The challenge today is how to maintain an economically viable and healthy agricultural landscape producing the food and fiber on which our country depends, while improving the agricultural environmental benefits our citizens enjoy. Agriculture provides not only the food and fiber of America, but is the largest offset provider against human activity. A healthy agricultural landscape provides clean air, water and open space.

NASDA urges you to carefully consider agriculture's needs as we continue efforts to enhance environmental protection while maintaining a viable farm production system. We would welcome the opportunity to discuss these critical issues and look forward to working with you.

Senator BOXER. Thank you very much, sir.

Senator Inhofe and I have been collaborating on how to deal with the time problem. We have come up with a plan.

I would ask the second panelists, is there anyone on the second panel who could not come back at 2 p.m.?

Can you all come back at 2 p.m.?

That is excellent. So what we are going to do is take the rest of our time. We don't have that much left, but we will now hear from our final speaker on this panel.

Catharine Fitzsimmons, Chief Air Quality Bureau, Iowa Department of Natural Resources, National Association of Clean Air Agencies, welcome.

STATEMENT OF CATHARINE FITZSIMMONS, CHIEF, AIR QUALITY BUREAU, IOWA DEPARTMENT OF NATURAL RESOURCES AND NATIONAL ASSOCIATION OF CLEAN AIR AGENCIES

Ms. FITZSIMMONS. Thank you. Good morning, Madam Chairman and members of the Committee.

Senator INHOFE. Move it a little closer, if you would, please.

Ms. FITZSIMMONS. Thank you.

My name is Catharine Fitzsimmons, and I am Chief of the Iowa Air Quality at the Department of Natural Resources.

I appear today on behalf of NACAA, the National Association of Clean Air Agencies, the association of air pollution control agencies in 54 states and territories and over 165 metropolitan areas across the Country.

NACAA's members are responsible for ensuring that our citizens breath clean air. We are required under the Clean Air Act to develop State implementation plans demonstrating that areas attain and maintain the national ambient air quality standards. In developing these plans, we analyze every important source of pollution, large and small, ranging from electric utilities and other industrial sources, from cars and trucks to even bakeries and dry cleaners.

In light of the fact that plan development is a zero-sum calculation, our agencies do not have the luxury of ignoring any significant sources of air pollution. Accordingly, we are troubled by legislative and regulatory efforts to exempt large industrial size CAFOs from environmental laws. If CAFOs emit air pollutants that exceed permitting thresholds or reportable quantities, then just like any other sources of pollution, CAFOs should comply with environmental laws.

Our primary concern is with large industrial scale CAFOs that house thousands of dairy cows or beef cattle, tens of thousands of swine and hundreds of thousands, even millions, of chickens. These facilities are responsible for thousands of tons of manure and release in substantial quantities, air pollutants such as ammonia, hydrogen sulfide and particulate matter that can cause severe health effects including death, heart attacks and increased severity of asthma attacks.

In light of this, it seems obvious that like every other industry that has an impact on human health and the environment, CAFOs should comply with environmental laws. Instead, however, there have been several attempts to exempt CAFOs from these important statutes. Let me give you a few examples.

First, EPA entered into an agreement with the CAFO industry to fund a monitoring program to obtain emissions data in exchange for a safe harbor from Clean Air Act, CERCLA and EPCRA requirements.

The agreement has several major problems. It contains a much too broad enforcement waiver. Given the small number of farms that are being monitored, the data collected will not likely be representative, and there is no assurance that participating CAFOs or any CAFOs will be required to reduce their air emissions as a result of the agreement.

Second, we are concerned about regulatory and legislative efforts to exempt manure from CERCLA and EPCRA requirements. The implications of this exclusion are significant. Emergency responders would be prevented from having critical information about potentially dangerous releases, EPA or a State could not use CERCLA response authorities, and CAFOs would also be exempt from any natural resource damages, leaving the financial burden of any cleanup on the public.

Finally, we are concerned about efforts by an industry-dominated Federal advisory committee of the U.S. Department of Agriculture to limit the application of environmental laws to CAFOs. For example, last year the committee recommended defining the word, source, so narrowly that CAFOs might not face any requirements for controlling air emissions regardless of the results of the monitoring being conducted under the air compliance agreement for AFOs.

In summary, the well documented adverse health effects and substantial levels of air pollutants from CAFOs warrant rigorous application of environmental laws to these sources. It is exactly such sources that statutes such as the Clean Air Act, CERCLA and EPCRA are intended to address.

Attempts by Congress, EPA and other to exempt CAFOs from environmental laws and arguments made in support of such exemptions are inappropriate. Instead, CAFOs, like every other major industry in this Country, should be expected and required to accept their obligations and comply in full with environmental laws.

Thank you for the opportunity to testify.

[The prepared statement of Ms. Fitzsimmons follows:]

STATEMENT OF CATHARINE FITZSIMMONS, CHIEF, AIR QUALITY BUREAU, IOWA DEPARTMENT OF NATURAL RESOURCES AND NATIONAL ASSOCIATION OF CLEAN AIR AGENCIES

Good morning. My name is Catharine Fitzsimmons and I am Chief of the Air Quality Bureau of the Iowa Department of Natural Resources. I appear today on behalf of NACAA—the National Association of Clean Air Agencies—the association of air pollution control agencies in 54 states and territories and over 165 metropolitan areas across the country. I am pleased to have this opportunity to testify before this Committee on the important subject of confined animal feeding operations (CAFOs), their impacts on the environment and efforts to address those impacts.

NACAA's members are responsible for ensuring that our citizens breathe clean air. We are required under the Clean Air Act to develop State Implementation Plans (SIPs) demonstrating, to EPA's satisfaction, that areas attain the health-based National Ambient Air Quality Standards (NAAQS) by statutory deadlines and maintain clean air thereafter. In developing these plans, we analyze every important source of pollution, large and small, ranging from electric utilities to other industrial sources, from cars and trucks to even bakeries and dry cleaners. In light of the fact that SIP development is a zero sum calculation, our agencies do not have the luxury of ignoring any significant source of air pollution. Doing so would not only make our task substantially more difficult, if not impossible, but would also unfairly shift the burden of control to those sources that are already regulated.

Accordingly, we are troubled by legislative and regulatory efforts to exempt huge industrial-size CAFOs from environmental laws. If CAFOs produce air emissions that exceed permitting thresholds or reportable quantities, and thus potentially harm human health and the environment, then, just like other relatively equivalent sources of pollution, CAFOs should comply with the laws concerning those harmful emissions.

The Growing Size of the CAFO Industry and Proliferation of Industrial-Scale CAFOs

The animal farming industry in the U.S. is a tremendously large one, both in terms of numbers of animals and revenue. There are over 100 million head of cattle and calves in the U.S.,[1] and cash receipts for this industry in 2006 totaled $49.1 billion.[2] The U.S. swine industry is equally as large—more than 60 million head of hogs and pigs,[3] amounting to a $14.1 billion business in 2006.[4] For poultry, the numbers of animals are even more impressive: almost 350 million layer hens and more than 175 million chicks for meat production (known as "broilers"),[5] with the total farm value of U.S. poultry production exceeding $20 billion a year.[6]

This industry has also evolved, with fewer larger operations replacing more numerous smaller ones, even as production has grown dramatically. The broiler industry is a good example. According to the U.S. Department of Agriculture, in 1934, there were 11,405 facilities that hatched all chickens in the U.S. Those hatcheries had the capacity to incubate 276 million eggs at one time for an average capacity of 24,224 eggs. In 2001, there were 323 chicken hatcheries, with an incubator capacity of 862 million eggs; the average incubator capacity of a hatchery is 2.7 million eggs.[7]

NACAA's primary concern is with these industrial-scale CAFOs, those that house hundreds or thousands of animals. As the term CAFO suggests, most of these animals are housed in confined facilities: broiler houses usually handle between 20,000 and 30,000 birds per house[8] and swine finishing buildings in Iowa typically house 1200 to 2400 pigs each. It is these large CAFOs, not small family farms, that produce thousands of tons of manure and release air pollutants in levels of potential concern. The largest CAFOs house thousands of dairy cows or beef cattle, tens of thousands of swine and hundreds of thousands—even millions—of chickens.[9]

<u>Human Health and Environmental Impacts of CAFOs</u>

Air emissions from CAFOs can harm human health and the environment. These harmful emissions include ammonia, hydrogen sulfide and particulate matter, including fine particulate matter ($PM_{2.5}$).

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[1] National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture (USDA), "Cattle," (July 20, 2007), at 1 (available at http://usda.mannlib.cornell.edu/usda/current/Catt/Catt-07-20-2007.pdf).

[2] NASS, Agricultural Statistics Board, USDA, "Meat Animal Production, Disposition, and Income: 2006 Summary," (April 2007) at 1 (available at http://usda.mannlib.cornell.edu/usda/current/MeatAnimPr/MeatAnimPr-04-27-2007.pdf).

[3] NASS, Agricultural Statistics Board, USDA, "Quarterly Hogs and Pigs," (June 29, 2007) at 1 (available at http://usda.mannlib.cornell.edu/usda/current/HogsPigs/HogsPigs-06-29-2007.pdf).

[4] "Meat Animal Production, Disposition, and Income: 2006 Summary," *supra* note 2 at 1.

[5] NASS, Agricultural Statistics Board, USDA, "Chickens and Eggs: 2006 Summary," (Feb. 2007) at 1 (available at http://usda.mannlib.cornell.edu/usda/current/ChickEgg/ChickEgg-02-27-2007.pdf) and NASS, Agricultural Statistics Board, USDA, "Broiler Hatchery," (Aug. 22, 2007) at 1 (available at http://usda.mannlib.cornell.edu/usda/current/BroiHatc/BroiHatc-08-22-2007.pdf).

[6] Economic Research Service, USDA "Poultry and Eggs: Background" website, accessed on Aug. 29, 2007, http://www.ers.usda.gov/Briefing/Poultry/Background.htm.

[7] NASS, Agricultural Statistics Board, USDA, "U.S. Broiler Industry Structure," (Nov. 27, 2007) at 1 (available at http://usda.mannlib.cornell.edu/reports/nassr/poultry/industry-structure/specpo02.pdf).

[8] National Academy of Sciences, "Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs," (2003) at pp. 37-38.

[9] EPA's definition of a CAFO is at 40 CFR Part 122 Appendix B.

Human exposure to ammonia triggers respiratory problems, causes nasal and eye irritation and in large enough amounts can be fatal.[10] Ammonia also contributes directly to the formation of $PM_{2.5}$, which causes severe health effects in humans, including death, heart attacks and increased severity of asthma attacks, as well as visibility impairment.[11] Hydrogen sulfide is a toxic air pollutant that can cause severe health effects, even death, at high concentrations of exposure.[12]

Air emissions from CAFOs are, by no means, trivial. In fact, CAFO ammonia emissions represent *half* the U.S. ammonia emissions inventory.[13] In California, livestock ammonia emissions contribute 38 percent of the state's entire inventory of ammonia emissions. In San Joaquin Valley, 70 percent of the area's ammonia emissions are from livestock.

Emissions of ammonia from the largest CAFOs approach and even dwarf those of other industrial facilities. Monitoring of Premium Standard Farms (PSF) conducted by EPA (under a settlement agreement) in 2004 shows that PSF releases 3 million pounds of ammonia annually from barns and lagoons at its Somerset facility, making it the fifth largest industrial emitter of ammonia in the country.[14] Threemile Canyon Farms in Boardman, Oregon, reported that its 52,300-dairy-cow operation emits 15,500 pounds of ammonia per day, totaling more than 5,675,000 pounds per year.[15] That is 75,000 pounds *more* than the nation's number one manufacturing source of ammonia air pollution (CF Industries of Donaldson, Louisiana).[16]

Furthermore, CAFOs produce millions of tons of manure each year. According to EPA, CAFOs generate approximately 500 million tons of waste each year, three times more raw waste than is generated yearly by humans in the U.S.[17] Pollutants of concern in manure include ammonia, hydrogen sulfide, nitrogen, phosphorus, pathogens, antibiotics, hormones and particulates.[18] In Iowa, the greatest number of air complaints we receive

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[10] Schiffman, S.S., et al., *Health Effects of Aerial Emissions from Animal Production and Waste Management Systems*, available at http://www.cals.ncsu.edu/waste_mgt/natlcenter/summary.pdf and Agency for Toxic Substances and Disease Registry, "Public Health Statement for Ammonia" (September 2004), available at http://www.atsdr.cdc.gov/toxprofiles/phs126.html#bookmark05.

[11] EPA, "Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information," (OAQPS Staff Paper) (December 2005) (available at http://www.epa.gov/ttn/naaqs/standards/pm/data/pmstaffpaper_20051221.pdf).

[12] Agency for Toxic Substances and Disease Registry, "Public Health Statement for Hydrogen Sulfide" (July 2006), available at http://www.atsdr.cdc.gov/toxprofiles/phs114.html.

[13] National Academy of Sciences report, *supra* note 8, at 51.

[14] Premium Standard Farms, *Air Emissions Monitoring Completion Report* (Nov. 17, 2004) and EPA, "Toxics Release Inventory" (2004), available at http://www.epa.gov/triexplorer.

[15] Letter from Tom Lindley on behalf of Threemile Canyon Farms to EPA Region X, April 18, 2005.

[16] U.S. EPA, Toxics Release Inventory, 2003, http://www.epa.gov/triexplorer/.

[17] EPA, "National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations—Final Rule," 68 *Federal Register* 7176 (February 12, 2003) at 7180.

[18] Id., and EPA, "Environmental Assessment of Proposed Revisions to National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations," (January 2001) at pp.3-1 to 3-17 (available at http://www.epa.gov/waterscience/guide/cafo/envir.html).

concern emissions from land application of manure. In 2006, Iowa monitored 10 homes for ammonia and hydrogen sulfide emissions to assess the air emissions of CAFOs and recorded high ammonia emissions on a regular basis and high hydrogen sulfide emissions periodically.[19]

Given the focus of our association on air pollution, our testimony deals only with air emissions from manure, but pollutants from manure also have a tremendous impact on water quality—for example, livestock wastes can contribute up to 37 percent of total nitrogen loads and up to 65 percent of total phosphorus loads in surface waters.[20]

In light of these statistics, it seems obvious that, like every other industry that has an impact on human health and the environment, CAFOs should comply with environmental laws. Instead, however, there have been numerous attempts to exempt the agricultural industry—including CAFOs—from environmental laws. Any such exemptions are of serious concern to NACAA. Let me review them in more detail.

AFO Air Compliance Agreement

In 2002, NACAA was informed by EPA that the agency had been approached by representatives of certain animal farming associations (which we will refer to as the "CAFO industry") about entering into an agreement under which CAFOs would fund a monitoring program to obtain emission data in exchange for a "safe harbor" from enforcement of certain Clean Air Act; Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and Emergency Planning and Community Right to Know Act (EPCRA) requirements. Our association expressed to EPA that although gathering air emissions data from CAFOs was a worthwhile exercise, we had numerous concerns with the agreement as drafted. As negotiations between EPA and the CAFO industry on the agreement progressed, we continued to voice our objections, but to no avail. The final agreement—called the Air Compliance Agreement for AFOs[21]—contains many highly problematic provisions.

First, the enforcement waiver is too broadly defined. CAFOs participating in the agreement, regardless of whether their air emissions are monitored, receive a waiver from enforcement of the Clean Air Act, CERCLA and EPCRA. The waiver applies retroactively, during the period of agreement, and—potentially—forever. The waiver also intrudes on state prerogatives to regulate sources in order to attain the health-based air quality standards.[22]

[19] Iowa Department of Natural Resources Ambient Air Monitoring Group, "Results of the Iowa DNR Animal Feeding Odor Study" (January 2006).
[20] Environmental Assessment, *supra* note 18 at pp. 2-21-2-22.
[21] EPA, "Animal Feeding Consent Order Agreement and Final Order," 70 *Federal Register* 4958 (Jan. 31, 2005).
[22] The waiver applies to "[c]ivil violations of the permitting requirements contained in Title I, Parts C and D, and Title V of the Clean Air Act, and any other federally enforceable State implementation plan (SIP) requirements for major or minor sources based on quantities, rates, or concentrations of air emissions of pollutants that will be monitored under this Agreement." Id. at 4963. Thus it even waives civil violations of requirements in a state's federally enforceable SIP.

Second, fewer than 1 percent of the farms covered by the agreement will be monitored, which severely limits the amount of data collected. According to EPA, 6,267 farms signed up to receive the waiver,[23] but there are only 20 monitoring sites in 9 states.[24] Thus, there is no assurance that the data that are collected will be representative. Nor is it clear that enough data will be collected to advance the understanding and characteristics of emission sources or address the concerns regarding emission estimates highlighted by the National Academy of Sciences in its 2003 report on air emissions from CAFOs.[25] In addition, thousands of farm operators receive a waiver from enforcement even though no emissions data are being gathered from their farms.

Furthermore, the agreement does not require participants to adopt, or even test, any best management practices or technologies to reduce air emissions, therefore providing no assurance that air emissions will be reduced as a result of the agreement.

Finally, five years have elapsed since we first learned of the CAFO industry proposal, and monitoring that is scheduled to last for two years has just begun. Thus at least seven years will have passed without progress being made on monitoring emissions or, more importantly, *reducing* air emissions from CAFOs. In addition, participating CAFOs are not required to comply prospectively with Clean Air Act obligations until after EPA publishes an emissions-estimation methodology,[26] and since there is no timeframe for EPA to publish such a methodology, it may be years even after monitoring is completed before CAFOs are required to reduce their emissions. Moreover, given a certain interpretation of the Clean Air Act being sought by some members of the CAFO industry, which I will discuss later, the Clean Air Act may *never* apply to these operations, despite their substantial air emissions.

CERCLA/EPCRA Regulatory and Legislative Exemptions

We are also concerned about regulatory and legislative efforts to exempt CAFOs from CERCLA and EPCRA requirements. This spring, EPA Administrator Stephen L. Johnson testified before the House Energy and Commerce Committee and the Senate Environment and Public Works Committee that EPA planned to exempt emissions of air pollutants from manure from reporting requirements under CERCLA and EPCRA. Several bills have been introduced in previous Congresses to exempt CAFOs from CERCLA and EPCRA, and legislation (S. 807) has been introduced in the current Congress to exclude manure from the definitions of "hazardous substance" and "pollutant or contaminant" under both these acts.

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[23] EPA press release, "EPA Takes Important Step in Controlling Air Pollution from Farm Country Animal Feeding Operations," (Aug. 22, 2006).
[24] Presentation of Al Heber to the USDA Agricultural Air Quality Task Force on National Air Emissions Monitoring Study (May 2007), slides 4 and 8 (available at http://www.airquality.nrcs.usda.gov/AAQTF/Documents/index.html).
[25] National Academy of Sciences report, *supra* note 8.
[26] 70 *Federal Register* at pp. 4963-4964.

If manure were excluded from the definitions of "hazardous substance" and "pollutant or contaminant," releases or threatened releases of hazardous components of manure would not be covered by CERCLA or EPCRA. The implications of such an exclusion are significant.

First, the CERCLA and EPCRA requirements to report hazardous releases of toxic chemicals associated with manure, including ammonia and hydrogen sulfide, would be eliminated, preventing local, state and federal emergency responders from having critical information about potentially dangerous releases that could affect communities. Second, EPA or a state could not use CERCLA response authorities to respond to hazardous substances released from manure (e.g., investigations or clean-up) that threaten the environment, welfare or public health. Third, EPA would be prevented from taking action, including issuing abatement orders, in situations where there is an imminent and substantial endangerment to the public health, welfare or environment. Fourth, CAFOs would also be exempt from any natural resource damages that may result from a release of a hazardous substance, leaving the financial burden of any cleanup on the public.

The release of toxic substances from manure in amounts dangerous to human health is not a theoretical exercise—people have been killed. As reported in the *Dayton Daily News*, "At least 24 people in the Midwest have died from inhaling hydrogen sulfide and methane from manure since the 1970s, including fifth-generation Michigan dairy farmer Carl Theuerkauf and four members of his family, who collapsed one by one in 1989 after breathing methane gas from a manure pit."[27] More recently, in July of this year four members of a Shenandoah Valley dairy farming family and a hired hand died after breathing methane gas fumes in a manure pit.[28] Thus, given this evidence, releases from manure can be dangerous and thus should not be excluded from the definition of "hazardous substance" or "pollutant or contaminant" in CERCLA and EPCRA.

In addition, the reporting requirements in these acts are useful to state and local air regulators. Given the paucity of monitors in rural states, CERCLA and EPCRA reports may be the only source of information to people affected by excessive air emissions from CAFOs.

Such an exemption also interferes with the Air Compliance Agreement I mentioned previously. Farms participating in this monitoring study have already received a waiver from enforcement of CERCLA and EPCRA provisions for air emissions of hydrogen sulfide and ammonia. Neither EPA nor Congress should consider a blanket exemption from reporting requirements for air pollutant emissions from manure while data on this very subject are being collected. We are also concerned about the precedent such an exemption will set with respect to application of the Clean Air Act to air emissions from manure.

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[27] Wagner and Sutherly, "The supersizing of America's livestock farms," *Dayton Daily News* (December 1, 2002).

[28] Bill Brubaker, "Four Family Members, Farmhand Killed by Gas Fumes in Methane Pit," *The Washington Post*, B06 (July 4, 2007).

PM NAAQS

Last year, EPA proposed a new NAAQS for particulate matter (PM).[29] The agency's proposal included a new "coarse PM standard" that would cover particles larger than so-called fine particulates (known as $PM_{2.5}$) up to particles less than or equal to 10 micrometers in diameter (PM_{10}). This coarse PM indicator ($PM_{10-2.5}$) would have excluded "any ambient mix of $PM_{10-2.5}$ that is dominated by rural windblown dust and soils and PM generated by agricultural and mining sources."[30] In other words, EPA proposed to exclude agricultural sources from a health-based air standard despite extensive evidence that agricultural operations can contaminate the environment.

In our comments to EPA on that proposal, NACAA cited evidence of the environmental impacts of agricultural operations, including that manure contains pollutants such as ammonia and other nutrients, organic matter, solids, pathogens, odorous compounds, trace metals, pesticides, antibiotics and hormones. We said an exemption for agricultural operations does not comport with science, since it is likely that pesticide-laden and toxics-laden coarse particles from agriculture pose risks similar to the coarse PM included in the standard (urban coarse PM dominated by resuspended dust from high-density traffic and industrial sources). We opposed carving out an exemption for agricultural sources from application of the health-based coarse PM standard, since excluding these sources implies their emissions are not harmful, and yet, EPA did not present any such evidence—on the contrary, substantial evidence exists that emissions from CAFOs *do* contaminate the environment with harmful substances.

In its final PM NAAQS decision, EPA dropped consideration of a coarse PM standard, instead retaining the existing 24-hour PM standard, with no exemptions.[31]

While we are pleased that agricultural activities were not exempted from the PM NAAQS, we remain troubled with language in the final preamble that treats agriculture favorably as compared to other industries. The preamble states that "EPA believes" that conservation systems and activities approved by the U.S. Department of Agriculture (USDA), when properly implemented, "should satisfy the requirements for reasonably available control measures or best available control measures."[32] It is unprecedented for EPA, in setting a health-based air quality standard, to address implementation issues such as what constitutes reasonably available or best available control measures. EPA never discussed this with NACAA members, even though EPA and state and local clean air agencies share a co-regulator status. We have no opinion on the merits of USDA conservation systems and activities, but we are disappointed that EPA would presumptively declare them adequate control measures for air pollution without first

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[29] EPA, "National Ambient Air Quality Standards for Particulate Matter—Proposed Rule," 71 *Federal Register* 2620 (Jan. 17, 2006).
[30] Id. at 2667-2668.
[31] EPA, "National Ambient Air Quality Standards for Particulate Matter—Final Rule," 71 *Federal Register* 61144 (Oct. 17, 2006).
[32] Id. at 61215.

discussing the matter with the state and local officials who hold primary responsibility for achieving and sustaining clean air standards.

Other Contemplated Exemptions

Finally, we are also concerned about efforts by a federal advisory committee of the U.S. Department of Agriculture, the Agricultural Air Quality Task Force (AAQTF), to limit the application of environmental laws to CAFOs. The Task Force has been criticized for a "lack of balance" since its 30 members include at least 10 representatives of "large scale agriculture industry," but only one environment organization representative[33] and only two representatives of state air pollution control agencies.

Last year the task force adopted a policy document with several recommendations for definitions that should be used in applying the Clean Air Act to emissions sources from agriculture.[34] These recommendations included defining the word "source" so narrowly that permitting/reporting thresholds for air pollutants would not be triggered, nor would control requirements be applicable. Thus, for example, if the term "source" is defined narrowly enough, CAFOs might not face *any* requirements for controlling air emissions, regardless of the results of the monitoring being conducted under the Air Compliance Agreement for AFOs.

The task force recommendations also include declaring that the definition of "pollutant" or "contaminant" should not include substances produced by natural biological processes (i.e., manure), even if the substance harms human health or the environment. This is similar to the amendments to CERCLA and EPCRA proposed in S.807, which we oppose, and we oppose the industry-dominated AAQTF's tinkering with these definitions for the same reasons.

Conclusion

In summary, the well-documented adverse health effects and substantial levels of air emissions from CAFOs—including ammonia and hydrogen sulfide—warrant rigorous application of environmental laws to these sources. It is exactly such sources that statutes such as the Clean Air Act, CERCLA and EPCRA are intended to address. Attempts by Congress, EPA and others to exempt CAFOs from environmental laws, and arguments made in support of such exemptions, are inappropriate. Instead, CAFOs, like every other major industry in this country, should be expected, and required, to accept their obligations and comply in full with environmental laws.

Thank you for the opportunity to testify.

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[33] Environmental Integrity Project, et al., Letter to Arlen Lancaster, Chief, Natural Resources Conservation Service, USDA, "The USDA-Agricultural Air Quality Task Force's Failure to Comply with the Federal Advisory Committee Act," (Jan. 30, 2007).
[34] USDA Agricultural Air Quality Task Force document adopted at March 2, 2006 meeting.

Senator BOXER. Thank you very much.

We are going to start our questioning. We are going to do it the early bird rule, and each of us will have 4 minutes, and I am going to try to enforce the rule. Let me start.

Mr. Blackham, you said at the end that you want to see cities and States and counties work together to resolve these issues, and I just wanted to pick up on the point because we have a list here of the folks who oppose weakening the health protections and the polluter pay principles, in other words, the people who support the current law. That includes the U.S. Conference of Mayors, the National Association of Counties, the National Association of City and County Health Officials, the American Public Health Association, the National League of Cities, the city of Waco, Texas, the city of Tulsa, Oklahoma, and it goes on.

So I just wanted to point out that when we say that we want the cities and counties to work in a cooperative way and the States, they have already spoken out. I guess that would. lead me to a question to Mr. Grumbles.

I am assuming that you would agree that, say, for example, the State of Oklahoma has the right to sue the CAFOs industry.

Mr. GRUMBLES. I would agree that they have the right to sue. It always depends on what statute or authority you are focusing on.

Certainly, the Agency respects and celebrates the fact, for instance, under the Clean Water Act, it is largely the States that carry out the programs that we oversee when we provide national standards. So throughout our efforts to strengthen control regulation over CAFOs and work.

Senator BOXER. They are suing under Superfund is my understanding. Is that right?

Mr. GRUMBLES. That is right.

Senator BOXER. Attorney General Edmondson, suing under Superfund?

Mr. EDMONDSON. That is one of our causes of action, yes, ma'am.

Senator BOXER. OK, one of them. So I wonder if you could talk to us because it is a big step. You are going up against a lot of giants, and I would like to know what was the straw that broke the camel's back that you decided that you needed to do the lawsuit.

Mr. EDMONDSON. We began negotiating with the industry in November 2001 and went through several years of unsuccessful negotiations. During that process, the city of Tulsa also found it necessary to file a lawsuit. They negotiated a settlement, and the industry began removing 70 percent of the litter out of the Eucha/Spavinaw of our watershed that provides drinking water to the city of Tulsa.

Even after doing that, they continued to surface supply in the Illinois River watershed and the other watersheds of western Arkansas and eastern Oklahoma.

The straw, if there was one, was simply a loss of patience. Every month that we negotiated was another month with litter being applied on the land.

Senator BOXER. What did you hear from the people in Oklahoma? Why were they upset about this?

Mr. EDMONDSON. They were upset about it in the State of Oklahoma for two reasons. One is this watershed is a recreational resource, and the water clarity and quality had declined dramatically over the last several decades, and the other is municipal and rural water districts rely on that watershed for drinking water.

As was mentioned by another panelist, heightened levels of chlorine were necessary in order to treat the levels of algae, and the more chlorine you use, the more risk you have of producing trihalomethanes which are a carcinogen. So it is Hobbesian choice for those who want that water to drink. They either get it smelling bad and tasting bad or they up their risk of cancer.

Senator BOXER. My last question, because I am running out of time, is to Mr. Hirsch. I really appreciated your very clear testimony, sir.

Livestock operations use antibiotics and hormones to promote growth and to reduce the likelihood of disease outbreaks in areas where animals are tightly packed together. Could you describe some of the USGS' findings concerning antibiotics and hormones in relation to livestock operations and some of the concerns that have spurred USGS to examine these pollutants?

Mr. HIRSCH. I think I would prefer to respond for the record to that. There is a lot of research. I am not familiar with the details of it, and I don't think it would be wise for me to try to delve into that at this time.

Senator BOXER. Do you agree that those antibiotics and hormones show up in the waste?

Mr. HIRSCH. Yes, they do.

Senator BOXER. Thank you.

All right, Senator Inhofe.

Senator INHOFE. Thank you, Madam Chairman.

First, Ms. Fitzsimmons, one quick question here: Are the public health departments in swine-intensive counties reporting higher incidents of respiratory problems than public health departments elsewhere?

Ms. FITZSIMMONS. I do not have data about every county in the State of Iowa or in other areas. However, Wellmark Blue Cross and Blue and the University of Iowa have conducted a number of health surveys that have annotated that.

Senator INHOFE. OK, that is fine. I think the answer is no on that, but we are on a fast track here.

Mr. Edmondson, your lawsuits against the poultry industry and you are asking the court to define animal waste as hazardous waste in 1972 CERCLA, my problem has been that it is not confined to the poultry industry, and I think that is the reason that the Farm Bureau and the Farmers Union and all the farmers are concerned about this. I would like to have you explain to us what you think the impact would be on those industries.

Mr. EDMONDSON. Thank you, Senator.

Our litigation was confined to the poultry industry.

I understand the concern felt by the cattle industry and others as to the possible future ramifications of our lawsuit. I don't think those concerns are valid in regard to cattle that graze and cattle droppings in a field. The concentrated feeding operations, whether they are bovine or swine, are still subject to stricter regulation than animals in a field, and I think that will remain the case.

We are not talking about rodeos. We are not talking about parades. We are talking about industrial level generation of waste.

Senator INHOFE. Well, some of the cattle waste, for example, has been used very productively in types of fertilizer and even some suggestion on energy being produced from these. It is concerning to me that the method of disposal, should that be declared as a hazardous waste, would be to lose all that, which could be an asset. Have you thought about that as being a problem?

Mr. EDMONDSON. I think it can be an asset, and I don't think the result of this lawsuit is going to keep that from happening. There are some very exciting ideas about there.

Senator INHOFE. I hate to keep rushing here. But in the lawsuit, and you are a smart, smart lawyer—I know that—is there any way that you could construct this thing to somehow confine it to the poultry industry or alleviate some of the problems that we see, that I see and that you see, I am sure too, and as well as our farmers see in Oklahoma?

Mr. EDMONDSON. Senator, we would be real happy in the event of a successful result to work with the court to make sure that the findings are so limited. Whether our lawsuit is successful or not, the chemicals are what is listed in CERCLA, and we are not going to add chemicals or remove chemicals from what is already covered under that statute.

Senator INHOFE. Thank you. Thank you, sir.

Mr. Sims, first of all, I wish there was more time. I could elaborate on the great loss that we have here, losing Craig Thomas. He and I were elected to the House at the same time and the Senate, and he served on this Committee, and he certainly is ably replaced by Senator Barrasso.

We have in Oklahoma a program that has been very successful. We had a hearing there, and we passed this into legislation. It is the partnership program with Fish and Wildlife.

I think you have commented in your written statement how successful these programs, the voluntary conservation programs, have been. Yet, I think there are probably some on this panel who feel that nothing is going to really be done and achieve environmental progress unless it is through a very heavy-handed regulation.

I would just like to know your experience and your feelings about that.

Mr. SIMS. Excuse me, Madam Chairman.

Senator, thank you for the opportunity.

We have seen across the Country that probably one of the biggest issues in this whole subject that we are talking about today is just the lack of understanding of the existing rules and regulations that are in place.

In many States across the Country, they already, the States themselves, the State environmental agency has more stringent regulations than the Federal Government, not in all States but in some States. And so, the States, a lot of them, have already been ahead of the curve on a lot of this.

But you have got some smaller operations that, even though they fall under this threshold of the numbers that we talked about of whether it is livestock or chickens or whatever, for the fact that they have had facilities that are built on live streams, like our grandfathers did years ago when they settled our part of the Country. Even though they are a small operation, they still meet the technical criteria of unacceptable conditions. That throws them under this CAFO definition.

So through voluntary efforts and education, we have been able to educate those folks and really make a lot of change out there on the ground to improve the water quality issue.

Senator INHOFE. Thank you, Mr Sims.

Senator BOXER. Thank you, Senator Inhofe.

Senator Carper.

Senator CARPER. Thank you, Madam Chair.

When I was the Governor of Delaware, we wrestled with, as most States did, what to do about welfare, how to make sure people got off welfare and were better off. We wrestled with how do we reduce incidents of teenage pregnancy. We wrestled with what do we do with agriculture runoff for years and years, and folks would clean out their chicken houses and simply use the litter as fertilizer on their fields.

What we did on welfare is we brought together a lot of folks who received welfare and said: You know this is not a good system. What can we do to make it better?

For teen pregnancy, we brought in teenagers from high schools all over our State and asked them to help us figure out what we ought to do on teenage pregnancy.

With respect to reducing agriculture runoff, really from chicken litter, we pulled together all kinds of farmers, environmentalists from our State. The EPA was good to participate. State offices were good to participate, Natural Resources and so forth, Department of Ag.

We said: Help us figure out what to do about this problem. We know there is a problem, and we can't keep going on this way.

We came up with the idea of requiring nutrient management plans to be developed and adopted for most of our significant, actually almost any animal operation of any size, and to train the folks, the farmers from those, whose nutrient management plan was adopted for their farm, to train them how to use it, how to implement it.

It is now enforced. It is enforced by the Department of Natural Resources, Department of Agriculture, and even the EPA from time to time will come by and get after somebody who needs to be gotten after. So this is something we have thought a whole lot about.

We have, in Delaware, 300 chickens for every person who lives in my State. So we have a fair amount of chicken litter. We have worked very hard for actually the last six or 7 years, and I am real proud of what we have done.

While I am not interested in completing exempting every animal feeding operation, certainly in Delaware or other places, from Superfund, I am interested in figuring out how do we provide some certainty, some protection that I would call the good actors as opposed to the bad actors.

If we wrote legislation here that clearly defined the normal application of fertilizer to be the use of a certified nutrient management plan, would that provide the peace of mind that the good actors are looking for and without exempting improper management from their liability?

That is my question. Let me just ask a couple of you to respond to it, if you will, starting with Mr. Grumbles, if you would share your thoughts on that question.

Attorney General Edmondson, welcome. We are glad you are here. Thanks for coming.

Mr. Sims, I was interested in asking you what size jacket you wear. I mean we would like to sign you up to play football for the University of Delaware.

[Laughter.]

Mr. SIMS. Is there a signing bonus?

Senator CARPER. And Commissioner Blackham, we would like to ask you to respond. If the four of you would take a shot at that, I would be grateful and just try to be succinct, if you will. Thanks.

Mr. GRUMBLES. Very succinctly, Senator, right now one of EPA's highest enforcement priorities is on the bad actors at CAFOs across the Country. That is one of our national priorities, enforcement priorities. So, like you, we want to focus on going after the bad actors and also encouraging and working with good actors.

In terms of the legislation, we are happy to work with you on that and look for ways to make progress.

A key for us is to advance the ball on nutrient management. One of the things you mentioned is a very positive one, and that is looking for incentives, which we are also doing with USDA, on getting CAFOs and AFOs across the Country to develop comprehensive nutrient management plans and nutrient management plans under the Clean Water Act regulatory program. We think that is the key to reducing nitrogen, phosphorus and other types of pollutants.

Senator CARPER. Thank you.

Senator BOXER. Senator Carper, because of the time, we are really going to have to move on. Do you want to pick one other person to be brief on that question?

Senator CARPER. The attorney general.

Mr. EDMONDSON. Thank you, Senator Carper, and I will be brief.

We have best management practices in Oklahoma, and I don't think any farmer is violating those.

The problem is the other half of the statute says that in no event shall surface application result in runoff, and that is what is happening. I think it would be very difficult to craft a statute that says you can apply at industrial levels and guarantee no runoff into the water.

Senator CARPER. If I could, Madam Chairman, I would like to ask Mr. Sims and Commissioner Blackham to respond for the record, please.

Senator BOXER. Would you do that, respond for the record?

Thank you.

Senator BOXER. Senator Barrasso, you have been very patient.

Senator BARRASSO. Thank you, Madam Chairman.

I am very pleased to have Olin Sims here today to testify on behalf of the National Association of Conservation Districts.

Senator Carper, we have a lot more like him at home, and we would be happy to find a place on our football schedule for anyone from Delaware.

Senator CARPER. We don't want to play you guys.

[Laughter.]

Senator BARRASSO. We did beat the University of Virginia this last weekend, 23 to 3, so it was a great weekend in Wyoming.

Senator BOXER. Well, Cal beat Tennessee, if we really want to get into it. I was at the game, but let us go on.

Senator BARRASSO. That is good.

[Laughter.]

Senator BARRASSO. Well, Mr. Sims' family runs a cow-calf operation, Madam Chairman, in south central Wyoming. From his experience on the ranch, as well as from his years of elected service on the Conservation District Board, he understands the challenges that livestock producers face on a yearly basis.

Many families in Wyoming run operations and elsewhere. They are concerned about how confined animal feeding operation regulations are going to impact their future. So Wyoming ranchers are concerned that expanding CAFO regulations are going to change their lives forever and not for the better.

Wyoming ranchers fear that as urban areas encroach upon rural communities across the West, that conflicts will grow and well funded special interest groups will force them to spend their hard-earned money in courtrooms rather than improving their land or investing in the future of our State. So they are frustrated by the refusal of so many to acknowledge that people who live and rely on the land for economic survival are often the best stewards of the land as we have seen time and time again in Wyoming.

After reading Mr. Sims' testimony, I have to say I am impressed by the efforts of our producers and by the conservation districts to improve the situation by doing it voluntarily and with incentives. I believe that their approach has been extremely successful, and their use of EQIP funds has been equally impressive.

As we listen to the testimony today, I hope all of us will remember that there are a lot of good things that are happening in America's agriculture community and that pursuing a one size fits all solution is, in fact, not a solution at all.

Mr. Sims, I would like to ask you to talk about the importance of flexibility, allowing States to have more responsibility to build their own successful programs and to tailor programs for the unique circumstances that each State develops individually.

Mr. Sims, please.

Mr. SIMS. Madam Chairman, members of the Committee, Mr. Barrasso, thank you very much.

I completely agree. I think the Federal Government, the regulatory agencies have a responsibility to set the goal, to set the environmental regulation that we need and then allow the States then to find the approaches, the best approaches that fit each area because we have got areas of the semi-arid West and Southwest.

Then we go to the South, the North Carolina folks that are dealing with hurricanes, and we go to New York, the State of New York, where they have 300 inches of snow. So we can't find the cookie cutter type regulation that is going to address all of these issues.

Let the Federal Government establish the goal. Let us figure out to achieve it. Yes, there needs to be consequences along the line, but there is a lot of good work on the ground.

I don't know that we need new regulation. We need to better implement what we have right now to look at new technologies. Conservation technical assistance is key. We need to make sure that the Federal Government funds NRCS to an appropriate level, to have producers out on the ground who work, excuse me, to have field technicians out on the ground to work with producers.

Producers want to do the right thing. Sometimes they just don't know what they need to do.

Senator BARRASSO. Thank you, Mr. Sims.

No further questions. Thank you, Madam Chair.

Senator BOXER. Thank you.

Senator, one thing you said struck me because there already is an exemption in the law for the normal application of fertilizer. I just want to make sure you were aware of that.

The next on our list is Senator Lautenberg.

Welcome, sir.

Senator LAUTENBERG. Thank you, Madam Chairman.

Coming from a State like New Jersey, these problems aren't quite as apparent. But, of course, we are, in this Committee and in this body, very much interested in reducing risks to the population from wherever it comes.

Oddly enough, the subject of waste removal here today accompanies a statement that was made on television this morning about what happens with ship exhausts, one ship producing more in a day than 365,000 cars. So we are overwhelmed by excessive pollution coming from all kinds of sources.

Mr. Edmondson, if we were to exempt factory farms from the authority of Superfund, would that not result in costs being passed along to the taxpayers?

Mr. EDMONDSON. I think it would result not in only costs going to the taxpayers. That is assuming that States or the Federal Government engage in cleanup of the mess. The alternative is untreated, uncorrected destruction of our environment and our waters.

Senator LAUTENBERG. If we did that, it would remove any incentive for these farms to reduce pollution from waste on their own. If we took it away from Superfund and had to pass other costs along, I don't know that we would get the cooperation that we need to solve some of these problems.

Madam Chairman, in the interest of time, I am going to ask that other questions that I have be able to be submitted for the record. The record, I assume, will be kept open for that purpose.

Senator BOXER. Yes, in fact, it will.

Senator LAUTENBERG. Thank you.

Senator BOXER. Senator Bond.

OPENING STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR FROM THE STATE OF MISSOURI

Senator BOND. Madam Chair, thank you very much for giving us an opportunity in this format. I regret that I have commitments in the Intelligence Committee this afternoon and will not be able to join you. We have a witness from Missouri on the second panel. I will have some questions for her.

Some of you may know that Missouri is home to extensive beef, hog, poultry and dairy farms and ranchers providing the food and dairy products for the Nation. We have a comprehensive set of laws with which they must abide, and Mr. Blackham's comment on pollution control through cooperative efforts reflects precisely what is going on in Missouri.

You can be very proud of what you are doing in your State and the other States. We have found that that works. I am very proud of our Missouri farmers and ranchers who make an honest living by playing by the rules to bring us nutritious and affordable beef, pork and poultry products.

As I mentioned, Chris Chinn from Emden, Missouri, will be testifying on the second panel. She is an example of the future of agriculture. I would note that the 2004 Missouri Farm Bureau Young Farmers and Ranchers Achievement Award went to Mrs. Chinn, and I am grateful for her willingness to come and share with us how she and her husband manage their hog farms and their parents' sow farrow-to-finish operation, respecting the environment and providing high quality pork products.

The Chinns and farmers in Missouri and across the Country have to follow a host of Federal and State Clean Water permitting nutrient management plan requirements, and they do so with pride. Together with their partners at the district, State and Federal level, they ensure adequate storage of manure, litter and wastewater. They ensure that clean water is diverted from production areas. They prevent contact between confined animals and waters.

They ensure that chemicals handled onsite are not disposed of in any manure. They identify site-specific conservation practices to implement, including buffers and controlled runoff of pollutants into waters, and they establish protocols for applying their manure in accordance with site-specific nutrient management practices. Our universities have been in the lead in helping with the Federal agencies, the development of those standards.

After EPA's coming CAFO rule is finalized, plans to apply these requirements will be open for public comment and contained in enforceable permits. That is an example of working together in partnership, which I support, and I support strongly punishing those who violate the law. We have the laws, and we have an obligation to protect the environment. When mistake are made, penalties must be paid and problems fixed.

What I do not support are efforts by some in Congress and certain groups to misuse our laws in ways never intended such as applying the Superfund Law intended for toxic industrial waste pollution instead to farmers and agriculture.

For organic farmers who use manure as a fertilizer, this would mean that their food products would come from a Superfund site. Would they have to disclose that?

The result of such a strategy seen here today in Oklahoma's lawsuit is litigation gridlock with endless court motions and no resolution. They don't improve the environment. Efforts to pay bounty contingency fees to trial lawyers bringing charges of violating the public trust and creating conflicts of interest by giving a financial interest to lawyers who may have given campaign contributions, that is not the way to improve the environment.

Supporters of Superfund abuse try to deny their efforts will hurt farmers. They neglect to mention that Superfund strict liability schemes makes anyone who contributes anything to the situation, no matter how small, liable for the entire cost of cleanup and, yes, it would apply to rodeos and parades.

Madam Chair, the vote has started. We are out of time. I thank you, and I ask unanimous consent to submit the rest of my statement and the questions for Mrs. Chinn for the record.

Senator BOXER. Absolutely, Senator Bond.

[The prepared statement of Senator Bond follows:]

STATEMENT OF HON. CHRISTOPHER S. BOND, U.S. SENATOR FROM THE STATE OF MISSOURI

Thank you Madame Chairman for holding this hearing on animal feeding operations. You may know that Missouri is home to extensive beef, hog, poultry and dairy farms and ranches meeting the needs of families across the Nation.

I am so proud of our Missouri farmers and ranchers who make an honest living playing by the rules to bring us nutritious and affordable beef, pork and poultry products.

Chris Chinn, from Emden, Missouri, is an example of the future of agriculture. I am grateful to her for sharing with us how she and her husband manage their hog farm and their parents' sow farrow-to-finish operation with respect for the environment.

The Chinns and farmers and ranchers across the country must follow a host of Federal and State clean water permitting and nutrient management plan requirements, and they do so with pride. Together with their partners at the district, State and Federal level they:

-ensure adequate storage of manure, litter and wastewater,

-ensure that clean water is diverted from production areas,

-prevent contact between confined animals and waters,

-ensure that chemicals handled onsite are not disposed of in any manure,

-identify site-specific conservation practices to implement including buffers to control runoff of pollutants into waters, and

-establish protocols for applying their manure in accordance with site-specific nutrient management practices.

After EPA's coming CAFO rule is finalized, plans to apply these requirements will be open for public comment and contained in enforceable permits. This is an example of working together in partnership to manage the land, which I fully support.

I also fully support punishing those who violate the law. We all have an obligation to protect the environment. When mistakes are made, penalties must be paid and problems fixed.

What I do not support are efforts by some in Congress and certain groups to misuse our laws in ways never intended, such as trying to apply the Superfund law intended for toxic waste and industrial pollution instead to farmers and agriculture.

The results of such a strategy seen here today in Oklahoma's lawsuit is litigation gridlock with endless court motions and no resolution. That does not improve the environment. Efforts to pay bounty contingency fees to trial lawyers bring charges of violating the public trust and creating conflicts of interest by giving a financial interest to lawyers who may have given campaign contributions. That is not the way to improve the environment.

Supporters of Superfund abuse try to deny that their efforts will hurt small farms. They neglect to mention that Superfund's strict liability scheme makes anyone who contributed anything to the situation, no matter how small, liable for the entire cost of cleanup.

This provision has already bankrupted countless small businesses caught up in toxic dump cases. I refuse to condemn farmers to that fate.

Supporters of Superfund abuse try to cite provisions of the Superfund law to support extending it to farms. However, they do not recite the provisions they could be violating by diverting recovered funds, which the law requires must go solely to clean up and restoration, instead to trial lawyers working on contingency they hired to pursue their suits.

We in the Heartland know that farmers overwhelmingly are great stewards of the land. They share our commitment to protecting the environment. We thank them for their commitment to providing affordable, abundant, and nutritious beef, pork, poultry and dairy products.

Thank you.

Senator BOXER. I want to put in the record an article from the Kansas City Star: Neighbors Say Nearby Dairy Farm Contaminates Their Wells With Manure. I want to put that in because I think sometimes we get off into the weeds of jurisdiction and argument.

[The referenced article can be found on page 150.]

To me, it has always been what is the real facts on the ground. What happens to our people? What is their quality of life?

I think we need to balance. I come from the largest agricultural State in the Union. People seem to forget that. We do have Hollywood and Silicon Valley, but we are the No. 1 ag State.

So we have to balance all of our needs, but there is no reason why we can't balance a clean and healthy environment with a prosperous, growing industry if people just had some sense of corporate responsibility because we are not talking about a few chickens. We are talking about some farms that have up to a million animals, and these folks don't live on the land. That is why I think we have to make a distinction between the people Senator Barrasso was so eloquent about and these huge, large scale operations.

This panel has been terrific. You have all brought your expertise.

We will leave the record open, and we look forward at 2 to hearing from panel two.

Senator CARPER. Madam Chair, just one last thing.

Senator BOXER. Yes, yes.

Senator CARPER. Several of our witnesses talked about things we can do in a technological way.

Senator BOXER. Yes.

Senator CARPER. One of the things we are proudest of in Delaware—I just visited it recently—is the folks from Perdue, Jim Perdue, who is actually a marine biologist and runs the Perdue poultry company, and the State of Delaware teamed up in a partnership to take about 10 to 15 percent of all the chicken litter off of the DelMarVa Peninsula and to pelletize it and sell it as a fertilizer, organic fertilizer all over the Country. That is the kind of solutions that are part of the way out of this as well.

Senator BOXER. Absolutely, Senator, I believe you are right, that we can protect the health of the people and still grow our economy. That always comes down to where I am at.

So I thank you very much.

We stand in recess, actually, until 2.

[Recess.]

Senator BOXER. The Committee shall come to order.

I want to thank Senator Inhofe for his very good suggestion that we work on this panel this afternoon. I really do appreciate our terrific witnesses waiting around, and I hope that you had some enjoyable lunch or chat.

So why don't we just get started?

Each of you will have 5 minutes. We will start with Chris Chinn, Farmer, American Farm Bureau Federation.

STATEMENT OF CHRIS CHINN, FARMER, AMERICAN FARM BUREAU FEDERATION

Mrs. CHINN. Thank you, Chairman Boxer, and I would like to thank the entire Committee for allowing me to speak today.

My name is Chris Chinn, and I am the Young Farmers and Ranchers Chair for the American Farm Bureau Federation. I also serve on the Board of Directors for the American Farm Bureau Federation.

My husband, Kevin, and I are fifth generation farmers, and we raise hogs along with other family members in northeastern Missouri. Kevin and I are also raising the sixth generation of family farmers. We have two young children. Their names are Conner and Rachelle.

Kevin and I actively support our local Lions Club, our county fair, our church, and we are active in our community with other civic and youth organizations. I also serve on the Board of Directors for the YMCA, and Kevin and I are both very active in our local and State Farm Bureaus.

Some Americans have a very nostalgic view of what they think agriculture should be. They think that we should raise our animals the same way that farmers did 50 years ago, but 50 years ago life on the farm was a lot harder, harder for the farmer, harder for the farm family and harder on our hogs.

As recently as 30 years ago, my family raised hogs in what people call a traditional manner. Our hogs were not protected from the weather, diseases or predators. But, today, our hogs are housed in climate-controlled facilities. This allows us to not only raise our hogs, but it also allows us to protect our environment.

Our farm is a family farm. Our parents, our siblings and our children live and work there. Many people would say that we are big farm. While my family farm may fulfill the perception of a big farm in terms of size, my family cares about the environment, we care about our community, and we care about our animals.

We follow and, in fact, many times, often go above and beyond Federal and State rules and regulations. My family has a comprehensive nutrient management plan as well as an environmental management system in place on our farm. Together, they ensure quality continued improvements as well as protecting our environment and our community.

We monitor daily rainfall, we test our soil, and we use best management practices. This is only a very short list of the many things that we do to protect our environment and keep our farm productive.

In fact, I am so certain that the air and water around my farm is clean that Kevin and I recently built a home within 200 yards of our water treatment lagoon. Visitors to our farm and my home think that the pretty patch of water out back is a pond. They don't know it is my lagoon unless we tell them.

My kids' favorite place to be on our farm is inside our hog barns, working beside their dad, and I feel that environment is just as safe as their schools. When they are in our barn——

Senator INHOFE. Let me interrupt to point out to everyone who is here that we are showing some of these charts of your farm that you are talking about, so it gives a little visual for your presentation.

Mrs. CHINN. Thank you, Senator.

As I said, my kids' favorite place to be is inside the barns, working with their father. They learn great, valuable lessons about how to care for our animals and all the intangible ethics that come from growing up on a farm.

I know that that environment inside our buildings, as you can see, is just as safe and clean as it can be. We have computer-controlled ventilation systems that ensure healthy air.

But Kevin and I are not alone in protecting our environment. We know many farmers across this Country who care for their land, their environment and their animals in the same manner that we do. This Country is very diverse with livestock operations, but the one thing that we all have in common is our desire to protect our environment.

American farmers and ranchers produce the most safe and abundant supply of food in this world, and I hope that I never, ever see a day when the majority of our food comes from China like my children's toys do today.

American farmers produce a safe and abundant supply of food, and it is dependable from farm to fork, and it is also a system that protects our environment.

Finally, please do not assume that just because my family farm may be big, it must be bad. Our farm supports multiple family owners representing five different families. We employ 40 people, not to mention all the other farmers who we work with in our community. We purchase all of our grain locally from our local farmers. That creates another market for their corn.

When you consider enacting new legislation or rules and regulations upon us, please keep in mind the impact that these rules and regulations will have on farmers like me, the communities that we represent and the other farmers that we support because without farmers, my rural community will die.

Thank you for the opportunity to be here today.

[The prepared statement of Mrs. Chinn follows:]

STATEMENT OF CHRIS CHINN, FARMER, AMERICAN FARM BUREAU FEDERATION

The American Farm Bureau Federation (AFBF) respectfully submits our views to the committee as it reviews the impact of Confined Animal Feeding Operations (CAFOs). As the Nation's largest general farm organization and the representative of millions of farmers and ranchers in every State in the Nation, AFBF has a vital interest in how animal care issues affecting our members are perceived, examined and decided.

OVERVIEW

Many people outside of agriculture and the livestock industry have concerns about the environmental and health impacts of livestock operations. Some have gone so far as to demonize livestock operations, calling them factory farms and industrial livestock production. In fact, many of these livestock farms continue to be family owned and operated. Contrary to anti-livestock rhetoric, this nation's livestock industry is proficient at producing safe and abundant food while protecting our natural resources. The industry is highly regulated and farmers often surpass requirements when fulfilling their roles as caretakers of the environment and good citizens of their communities.

It is often overlooked, but the vast majority of farmers who operate CAFOs are involved in a family based business, are highly educated college graduates, community leaders, and experts in science and technology. Most are trained in humane animal husbandry and environmental sciences and spend great amounts of time, money and other resources ensuring that their operations do not harm the environment. More good news is that the efficiency of livestock production in the United States ensures Americans can purchase beef, pork, eggs, turkey, chicken and milk that is safe, nutritious and affordable. Providing meat to the United States and international markets also supports hundreds of thousands of jobs on farms, in rural communities, and in value-added food chain facilities nationwide.

Livestock production helps drive our bedrock agricultural economy in the United States with receipts annually on par with crop receipts. This means that the total value of cattle, hog, sheep, broiler, turkey, egg, milk, butter, cheese, honey, and farm-raised fish sales is roughly equivalent to the dollars generated from selling wheat, corn, rice, hay, cotton, soybeans, peanuts, tobacco, fruits, nuts, vegetables, and greenhouse/nursery crops. Typically, cattle and sheep production has been located in areas where crop production is not economically practical, thus making efficient use of land resources that would otherwise lack an economic use. Hog, dairy, poultry, and egg production has historically been co-located with crop production to make the most efficient use of crop production and crop aftermath. This co-location continues today, with livestock operations locating near biofuels production and making highly efficient use of the by-products of ethanol production.

Livestock farms and ranches employ hundreds of thousands of workers, providing rural residents with jobs and benefits that would otherwise not exist. In the hog business alone, Iowa State University researchers estimate more than 34,000 full-time jobs are directly attributable to farm-level production, with more than 110,000 additional jobs in the processing/packing sector. In the cattle industry, the American Farm Bureau Federation estimates more than 23,000 employees work in feedyards alone. America's livestock producers work hard, not only to feed their own families, but the families of thousands of others whose livelihoods depend on producing and processing livestock and meat products. By virtue of feed they purchase for their livestock, these farmers also are supporting farmers involved in crop production.

America's livestock producers face generally low profit margins. They must watch expenses closely, so economics as well as science ensures they make judicious decisions when it comes to the use of livestock inputs. They consider carefully the impact of their activities on not only the quality of the end product, but on the quality of life of the livestock under their care.

America's livestock producers are the most efficient producers in the world, providing safe and wholesome meat, poultry, egg, and milk products despite regulatory burdens that far exceed those faced by their competitors in Asia and South America. Here in the United States, feed and other inputs cost more, labor costs more and is less available, yet despite this, our nation's innovative farmers and ranchers still produce among the best and safest all-around product in the world. That being said, this cannot continue indefinitely. Many operations are near the tipping point where needless regulation that accomplishes no real environmental or food safety goal will drive them out of business. Additional regulation means dollars out of the pockets of farmers and ranchers, pure and simple. While other facets of our economy simply pass along costs such as these, farmers—independent livestock producers in particular—do not have this option. The vast majority of farmers are price-takers, rather than price-setters, in our economic system. While America's livestock producers recognize the need for adequate regulations to ensure environmental quality, food safety and other science-based endeavors, they increasingly find their livelihoods threatened by government regulations that cross the threshold of common sense in attempts to address any number of perceived societal ills.

The population of the United States passed 300 million people in 2006. Many demographers predict that number will exceed 400 million by 2040. A sober question that must be asked is "how will we feed one-third more people in just 35 more years?" A short and equally sober answer would be "not from domestic food production if irrational regulations shift production of meat, milk, poultry, and eggs outside the United States."

If Americans are concerned about the environmental impacts of agricultural production and the safety of their foods and beverages, the Nation would be well-served to preserve food production here at home. Our nation has the best environmental and food safety protocols in the world. Recent concerns about the safety of imported foods point out the simple fact that if we make it so hard and cost-prohibitive for America's farmers and ranchers to stay in business, our nation will be forced to import a larger portion of our food. We will import most of that food from nations which have significantly fewer environmental, food safety and labor safeguards. Simply put, in a misguided effort to stamp out problems here at home that are either marginal or do not exist, we will create larger problems that are arguably more serious.

CLEAN WATER ACT

CAFOs are regulated by the Clean Water Act. They must either have zero discharges, or obtain a National Pollutant Discharge Elimination System (NPDES) permit. Contrary to the assertions of some, it would be incorrect to presume that all or even most CAFOs experience actual discharges to navigable waters. The evidence clearly demonstrates that CAFOs as a class cannot be presumed to be discharging, that the vast majority of CAFOs do not discharge, and that the probability is extremely high that a majority of CAFOs will never have a discharge in the future.

Livestock producers whose operations are classified as CAFOs, however, are highly regulated with some of the most stringent fines and enforcement actions available under the Clean Water Act. As with any regulated group, there are events and actors that cause a catastrophic failure of the regulatory system, and they must always be dealt with swiftly and in full accordance with the law. Spills and discharges can occur, but in spite of the rhetoric of anti-livestock groups, they are not the norm and do not represent the practices of the overwhelming majority of livestock producers.

In particular, we note that any animal feeding operation (pork, poultry, beef, dairy or horse) of almost any size faces potential enforcement and severe penalties for even a single discharge from the operation to waters of the United States. This was not the case (and was certainly not perceived to be the case) prior to EPA's 2003 CAFO rule. Perhaps even more important is that the 2003 rule extended CWA protections to the application of manure to CAFO lands. Under this change, the application of manure to these lands without appropriate and documented agronomic and conservation best management practices would make any resulting storm water runoff of pollutants to waters of the United States a CWA "discharge" potentially subject to substantial penalties.

These changes are monumental shifts in the Federal policies and regulations that govern animal feeding operations. They have created substantial and effective incentives for CAFOs to prevent any discharge from CAFO production areas and to use sound and effective manure application practices in land application areas. They represent substantial improvements in water quality protection. Moreover, these benefits will be realized even for CAFOs that do not need a Federal NPDES permit. This is a sound policy outcome because certain aspects of the Second Circuit Court of Appeals Waterkeeper ruling will make the permitting process for CAFOs that do seek permit coverage more bureaucratic, more cumbersome, and less adaptable to changing operational circumstances.

NUTRIENT MANAGEMENT PLANS

EPA's CAFO rule will require every permit to include a nutrient management plan. These plans contain management practices and procedures necessary to implement applicable effluent limitations and standards. NMPs will:

- Ensure adequate storage of manure, litter, and process wastewater, including procedures to ensure proper operation and maintenance of the storage facilities;
- Ensure proper management of mortalities (i.e., dead animals) . . . ;
- Ensure that clean water is diverted, as appropriate, from the production area;
- Prevent direct contact of confined animals with waters of the United States;
- Ensure that chemicals and other contaminants handled onsite are not disposed of in any manure, litter, [or] process wastewater . . . ;
- Identify appropriate site-specific conservation practices to be implemented, including as appropriate buffers or equivalent practices, to control runoff of pollutants to waters of the United States;
- Identify protocols for appropriate testing of manure, litter, process wastewater, and soil;
- Establish protocols to land apply manure, litter or process wastewater in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater; and
- Identify specific records that will be maintained to document the implementation and management of the minimum elements.

These provisions require (1) minimization of phosphorus and nitrogen transport from the field to surface waters through land application rates; (2) annual testing of manure for nitrogen and phosphorus content and 5-year testing of soil for phosphorus content; (3) periodic inspection of land application equipment; and (4) land application setbacks from waters or vegetated buffers.

INNOVATION

Beyond design and engineering of adequate structures to perform waste management, livestock producers today are employing new methods to reduce nutrients in a CAFO's internal waste stream. Modifying animal diets to reduce nutrient excretion and improvements in biological, physical, and chemical treatment processes for manure and wastewaters can reduce the acres of land needed to utilize manure nutrients. Furthermore, byproduct recovery processes are being developed that can transform waste into energy and other value-added products to be marketed off the farm. Additional management practices include costly and burdensome requirements like the daily inspections of water lines, weekly inspections of storm water and runoff diversion devices, and manure, litter or process wastewater impoundments, and maintenance of records documenting these daily and weekly inspections.

TWO-TIERED ASSURANCE

Existing data have established the fact that the vast majority of CAFOs do not discharge and should not be presumed to discharge.

The major livestock, poultry and egg producing states have State regulatory programs that involve permitting requirements. Under these programs, many states keep records of manure releases or discharges from livestock operations. Some also have strict requirements that CAFOs report not only "discharges" to the waters of the State or U.S., but also other types of permit violations, as well as manure spills, releases, or other incidents regardless of whether they involve waters of the U.S. Some of these states actively accept and act on public complaints about incidents, releases, or violations and they record the complaints and the actions taken in response. Some of these states require each regulated CAFO to have a periodic visit from a State regulator/inspector to check compliance.

The scope, extent and consistency of these publicly available release or discharge records have grown extensively since the late 1990's. While there are differences in the information collected and reported; there is a sufficient quantity and quality of information available to indicate just how rare CAFO discharges to waters of the U.S. really are. Professor Terence Centner of the University of Georgia argues:

"To assume that data from 10 years ago reasonably describes the current water quality conditions requires that the locations and practices of AFOs have not undergone any significant changes. It also assumes that if any changes have occurred due to the expansion or demise of operations, they have not markedly altered the pollution reported in the early 1990's. Furthermore, reliance on this data assumes polluters of the 1990's are engaged in the same activities today and that they have not implemented new pollution-prevention practices. Given the available data on current AFO practices, these assumptions are simply not realistic" (4).[1]

PROTECTING AIR QUALITY

The vast majority of farmers and ranchers live on or near their livestock operations. This means they and their families breathe the same air as their neighbors. Most livestock farms are proactively instituting practices to reduce air quality concerns for the welfare or their workers, neighbors, animals, and their own families. Most operations are now using natural barriers such as tree screens to help mitigate air quality issues. These screens help to direct air flow from our barns and lagoons away from other rural residences. Modern facilities are now being built with computer controlled ventilation systems to ensure healthy indoor air. Although these common management practices help reduce emissions of odors, air particles, and gases, such as ammonia, there is much more that we do not understand about animal facilities and air emissions. A 2003 study conducted by the National Research Council of the National Academy of Sciences[2] and commissioned by the U.S. Environmental Protection Agency determined that there is insufficient data to fully understand the environmental and health impacts of large animal operations. In response to the NAS study, U.S. EPA is partnering with agricultural operations and land grant universities to measure air emissions from various types of livestock fa-

[1]See Centner (126–7) for a fuller explanation of recent changes in the AFO industry.

[2]National Research Council. Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs. 2003. Washington, DC. National Academies Press.

cilities. The aims of the National Air Emissions Monitoring[3] study are to collect accurate data and develop procedures to better estimate emissions from livestock facilities. It is important to note that over 2,500 livestock farmers are helping to share the cost of this study though voluntary participation. The USDA Air Quality Task Force[4] has brought more attention to agricultural air quality research needs; however, funding and support has fallen short. Scientific studies currently available have only scratched the surface, and the current patchwork of air regulations does not make sense for agriculture.

While the Clean Air Act sets national standards for criteria pollutants—such as nitrous oxides and fine and coarse particulate matter (PM), each State is charged with developing its own implementation plan to meet these standards in areas that have been given a non-attainment designation by U.S. EPA. EPA often offers guidance to states to reduce emissions, but this does not insure uniform treatment of agricultural operations across all states. As national air quality standards continue to be tightened, states with large agricultural production will be more apt to regulate agricultural sources in order to meet the Federal emissions mandates. Because air quality reviews are conducted every 5 years, it is difficult to deal with regulations that are constantly changing. In addition to Federal standards, individual states often impose additional air quality regulations and permitting requirements. In Missouri, State regulations set limits on odor emissions and require odor control plans separate of any Federal standards. Missouri also has optional programs to prevent pollution from agricultural feeding operations. This fragmented approach to air quality creates an uncertain environment for producers.

THE OVERKILL OF CERCLA

In addition to all the Federal and State laws that already regulate agriculture, livestock and poultry producers, and anyone else who uses or transports animal manure have yet another looming concern. Recent lawsuits from activists and local and State municipalities seek to expand Superfund liability to animal manure. Collectively, the litigation argues that manure should be considered a hazardous substance—just like radioactive and toxic waste—under the Superfund laws.

The Superfund laws—the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Emergency Planning and Community Right-to-Know Act (EPCRA)—were crafted to address toxic or abandoned waste situations such as the notorious Three Mile Island and Love Canal sites. Animal manure has not been regulated under these laws, nor do we think that the congressional record indicates that Congress ever intended for a natural substance like manure to be regulated under such a strict liability scheme.

Compounds are typically regulated under Superfund without regard to facility size. Further, the threshold amounts of compound triggering clean-up requirements are from a business perspective, very small. Superfund was designed to mandate cleanup of compounds that are very harmful even in small amounts—manure is a beneficial and natural product that does not fit that description. Proper production use, storage and disposal of manure is certainly not harmful to human health or the environment. Numerous Federal and State laws are in place to regulate farms when and where manure is found in areas and quantities that could pose an environmental or health risk if handled improperly. If the courts do eventually classify manure as a hazardous substance under Superfund, then the liability and consequences to farmers and ranchers will negatively alter the viability and structure of American livestock and poultry production.

Most farms with animals could be exposed to severe liabilities and penalties as a result of being brought under the Superfund laws. Farmers may lose the option of using manure and be forced to rely on commercial fertilizer at three or more times its cost. And, ironically, manure and commercial fertilizer pose similar risks to the environment from over-application, runoff and air emissions. Congress did exclude the normal application of "commercial fertilizers" from Superfund liability, so it seems only reasonable that land application of manure as fertilizer should be afforded the same status.

Superfund already has a legacy of bankrupting small businesses caught in its path. If manure is determined to be a hazardous substance, the cost of technical monitoring and compliance will drastically affect small-and medium-sized farmers the most, while large producers with far greater financial resources would be better able to absorb the compliance and cleanup costs.

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[3] http://cobweb.ecn.purdue.edu/?odor/NAEMS/
[4] http://www.airquality.nrcs.usda.gov/AAQTF/

The risk of potential liability under the Superfund laws has compelled companies in other industries to relocate or significantly shift their facilities out of the U.S. American animal production is integrated, and future relocation decisions could result in the loss of animal-production contracts for farmers, leaving thousands of folks in financial ruin with empty barns.

The organic foods industry would be affected by any decision to classify as hazardous the use of manure as fertilizer. It is unclear how farmers who use organic methods would be allowed to continue applying manure to their crops, just as it is uncertain whether any effective, alternative fertilizer would be certified for use under organic standards.

Farmers and ranchers support research into new uses for manure. Using manure as a fuel source to generate energy shows great promise and Federal, State and private investment is being made into research. Moreover, hazardous substances simply are not used for energy generation. Which is precisely why petroleum based fuels are exempted from Superfund liability. Superfund liability would stifle innovation just as the promise of developing renewable energy from manure is getting under way. If manure is classified as hazardous waste under Superfund, using manure to generate energy—through methane digesters, for instance—could result in entrepreneurs and scientists being held liable for cleanup costs under CERCLA which would preclude the use of manure as a potential energy source.

CONCLUSION

Farmers and ranchers understand their roles in improving and maintaining the health and safety of the nations' environmental resources. Farmers are sensitive to the environment because they own and manage two-thirds of the nation's land. They are doing their part to promote the principles of environmental stewardship by being good caretakers of the nation's soil, air and water resources. But the cost of this stewardship is not cheap. Meeting the demand for food, feed and fuel as well as society's demands for improved environment quality requires farmers and ranchers to balance, and often individually bear, the cost of achieving many competing goals and objectives.

Agriculture's impacts on the environment are closely intertwined with countless human activities that yield a higher quality of life for all Americans. Our ability to increase agricultural productivity—with the use of modern crop production tools like fertilizers—has enabled our nation's farmers and ranchers to increase the production of food, feed and fuel without increasing the acreage of cropland. Our productive capacity is unprecedented in the world's history and allows our farmers and ranchers to meet the demands of our nation's growing population as well as growing world populations and markets abroad. On top of this unprecedented productivity, there is little doubt that farmers and ranchers have made great strides in improving our environment over the last three decades. By nearly every measure, our environment and natural resources are in better condition than any other time in recent history.

Last, we ask members to seek a balanced policy that will avoid business as usual, and steers way from classic command and control approaches. Agriculture is a delicate and interdependent economic activity and the originating link in the nations' food chain. Livestock production in the United States must survive and profit. It is essential to the health and livelihoods of many related aspects of agriculture, such as feed grain production, and many support sectors of our rural economies. If animal agriculture loses its economic sustainability due to overregulation, American consumers would be left to depend on foreign food imports, likely grown with less regard for food safety.

Senator BOXER. Thank you so much, Chris.

Nick Nemec, and let me say Farmer, Western Organization of Resource Councils and Dakota Rural Action.

STATEMENT OF NICK NEMEC, FARMER, WESTERN ORGANIZATION OF RESOURCE COUNCILS AND DAKOTA RURAL ACTION

Mr. NEMEC. Thank you, Madam Chair and members of the Committee for giving me this opportunity to testify.

My name is Nicholas Nemec, and I farm and ranch on 4,100 acres in Hyde County, South Dakota. From 1993 to 1996, I represented my area in our State Legislature.

I am here today as a member of the Western Organization of Resource Councils and Dakota Rural Action, two non-profit organizations with over 9,700 members in 7 western States.

My roots in agriculture in South Dakota run deep. My great-great-grandparents and great-grandparents immigrated to America from Eastern Europe early in the last century and homestead in South Dakota in 1907.

Those roots were threatened in early 1997 when Tyson Foods approached our county commissioners with a plan to construct over 100 hog confinement barns that would feed over a half million hogs each year and plans to build more barns in future years. With the endorsement of the county commissioners and city council in hand, Tyson Foods thought the door was open for a major expansion into South Dakota. Little did they know that the South Dakota State motto is Under God, the People Rule, and in Hyde County, the people eventually did rule.

My wife and I and our neighbors were worried because we knew that our county had no zoning ordinances of any kind of even a requirement for building permits. We were worried that we might wake up some day and find a large hog barn being built across the fence or down the road from our farms.

Hyde County is an area with tens of thousands of acres of shallow lakes and wetlands and many intermittent streams. People were concerned about the pollution that could be caused if the dikes around one of the manure cesspools at the proposed hog farms would fail. The manure would run into our lakes and streams, killing wildlife and vegetation and contaminating our shallow aquifers. These kinds of failures occurred in North Carolina.

We were also concerned about runoff from fields where manure had been applied at rates greater than the crops could use.

We are rural people and are used to and not afraid of the smell of a little manure, but promises by Tyson Foods to be a good neighbor and glowing testimonials from Hughes County, Oklahoma, where Tyson had a similar operation, did not allay our concerns about odor and pollution.

We were able to contact citizens of Hughes County, who told a very different story. They told of being prisoners in their own homes and being unable to open the windows because the stench of manure cesspools permeated everything. They told of being unable to enjoy the outdoors because the stench was so overwhelming that it made their eyes water and gave them headaches. In short, their quality of life was what we feared ours would become.

My oldest daughter has asthma. My wife and I had read that particulate matter in the air around large hog confinement barns and the stench from the manure cesspools triggers asthma attacks in some people. Watching your child fight to get air during an asthma attack and rushing her to a hospital is a scary experience that we didn't want to ever have to go through again.

With the help of Dakota Rural Action, we began drafting an ordinance that prohibited locating a manure management system for livestock housed in barns closer than four miles from any existing residential structure. The ordinance passed by a margin of 56 to 43 percent.

The rural vote of 75 percent in favor versus the town vote of 46 percent of the ordinance reveals the divisive nature this issue had on our small community, pitting urban against rural with the rural residents, mainly ag producers, supporting stricter controls.

It also illustrates the distinction that many of us in agriculture make between this new model of livestock production and the family farm model that is traditional in our rural communities. I call these new operations, factory farms, to distinguish them from traditional family farms.

The factory farm model is often promoted as the next logical step in the modernization and industrialization of agriculture. It is, in fact, bringing with it a host of new concerns. Communities are suddenly dealing with regulating and permitting operations that are touted as agriculture when, in fact, they are more similar to industrial production facilities than traditional family farms. The result is that factory farms have proven to have many unanticipated consequences to the environment and the high quality of life that sets our rural communities apart.

Townships, counties and even States across the Nation are struggling to handle the impacts of these factory farms. Many have established moratoriums in an attempt to put in place adequate laws and regulations to protect their citizens, natural resources and their quality of life from the unintended consequences of factory farm development.

While we in Hyde County have tried to protect our local environment, we also knew that a local county zoning ordinance couldn't protect us from manure spills in counties upstream. Water, creeks and, for that matter, manure run downhill and don't respect county or State lines.

In closing, I understand that there are proposals to exempt factory farms from some of our Federal environmental laws, and I urge you to oppose these efforts and to preserve the clean air and water standards we have for factory farms and all of agriculture as well as those to ensure that toxic waste sites are cleaned up and that the public is given information about emissions of pollutants and contaminants.

As a farmer and rancher, I do not feel threatened by these laws. They are not designed to punish responsible farmers of any size or type, and I am not aware of a single instance where they have been used to do so. These laws are designed to ensure the health and well being of my family, my land and my downstream and downwind neighbors. Today, more than ever, we need to maintain and even strengthen them to protect the communities in which factory farms are operating.

Thank you.

[The prepared statement of Mr. Nemec follows:]

STATEMENT OF NICHOLAS NEMEC, FARMER, WESTERN ORGANIZATION OF RESOURCE COUNCILS AND DAKOTA RURAL ACTION

Thank you, Madam Chair and members of the Committee for giving me this opportunity to testify. My name is Nicholas Nemec. I am a farmer and rancher from central South Dakota where I raise cattle, wheat, sunflowers, corn, and hay on 4,100 acres in Hyde County. From 1993–1996, I represented six central South Dakota counties in the State legislature.

I am here today representing the Western Organization of Resource Councils (WORC) and Dakota Rural Action (DRA), two non-profit organizations that have worked proactively for family farm agriculture in the West for nearly 30 years. WORC is a network of grassroots organizations from seven western states that includes 9,700 members and 44 local community groups. About a third of WORC's members are family farmers and ranchers. WORC has many members who are affected by or could be affected by large factory farms and are working on the issue in local, state, and Federal Government settings.

My roots in agriculture and South Dakota run deep. My great-great-grandparents and great-grandparents immigrated to America from Eastern Europe early in the last century. They homesteaded in South Dakota in 1907 and in their struggle to establish a foothold in this country and a future life for our family they experienced all the hardships that were so common to homesteaders, including the death of my great-great-grandmother, who was bitten by a rattlesnake at the door of her sod house. That original homestead is now owned by my uncle and last week, at the South Dakota State Fair, was recognized as a Century Farm.

Those roots were threatened in early 1997, when Tyson Foods approached our county commissioners with a plan to construct over 100 hog confinement barns that would feed nearly 520,000 hogs each year and plans to build more barns in future years. All this would happen that spring in a small county of only 860 square miles and 1,600 people. The county commissioners and the city council both passed resolutions welcoming Tyson Foods and their hogs to our county under the guise of "economic development". With the endorsement of the two local governing bodies in hand, Tyson Foods thought the door was open for a major expansion into South Dakota. Little did they know that the South Dakota State motto is "Under God the People Rule" and in Hyde County the people would eventually rule.

My wife and I and our neighbors were very worried because we knew that our county had no zoning ordinances of any kind or even a requirement for building permits. We were worried that we might wake up someday and find a large hog barn being built across the fence or down the road from our farms. Hyde County is in the Prairie Pothole region of South Dakota. It is an area with tens of thousands of acres of shallow lakes and wetlands and many intermittent streams. This area is one of the premier duck nesting areas in North America. One of those streams, South Medicine Knoll Creek, meanders for two miles through my farm. I have several shallow wells on the banks of the creek that I use to water cattle. I have watched this creek grow from a few isolated fishing holes to a river 100 yards wide and 8 feet deep in less than a day. Our county was experiencing severe flooding that spring. The creeks were high and the lakes were full. People were concerned about the pollution that could be caused if the dikes around one of the manure cesspools at the proposed hog barns would fail. That manure would run into our lakes and streams, killing wildlife and vegetation and contaminating our shallow aquifers. Those kinds of failures had occurred in North Carolina. We were also concerned about runoff from fields where manure had been applied at rates greater than the crops could use.

We are rural people and are used to and not afraid of the smell of a little manure. But we also know that the more manure you have the worse it smells and we didn't want to wake up every morning and spend everyday smelling hog manure. Promises by Tyson Foods to be a good neighbor and glowing testimonials from Hughes County, Oklahoma, where Tyson had a similar operation did not allay our concerns. With very little difficulty we were able to contact citizens of Hughes County who told a very different story about living amongst tens of thousands of hogs. They told of being prisoners in their own homes, unable to open the windows because the stench of manure cesspools permeated everything. They told of being unable to enjoy the outdoors because the stench was so overwhelming that it made their eyes water and gave them headaches. In short, their quality of life was what we feared ours would become.

Our oldest daughter has asthma. My wife and I had read that particulate matter in the air around large hog confinement barns and the stench from the manure cesspools triggered asthma attacks in some people. Watching your child fight to get air during an asthma attack and rushing her to a hospital is a scary experience that we didn't want to go through ever again that I wish no other parent has to go through.

The opponents to the Tyson plan began meeting and formed an ad hoc group to determine what, if anything, could be done to slow or stop Tyson Foods. We contacted several lawyers and learned that in our State the citizens of a county have the right to circulate petitions to force a special election on an initiated measure. With the help of Dakota Rural Action, we began drafting an ordinance to require a setback from residential structures. We also set up several informational meetings to gauge the level of concern. Eventually an ordinance was written that prohibited locating a manure management system for livestock housed in barns closer than four miles from any existing residential structure.

The hard fought election divided our county with the rural residents, farmers, and ranchers supporting the proposed ordinance and the local business community in town opposing it. Tyson Foods' purchase of multiple full page ads in the local eight page newspaper was seen as another heavy-handed attempt to sway the election. The ordinance passed by a margin of 56 percent–43 percent. The rural vote of 75 percent–25 percent versus the town vote of 46 percent–54 percent reveals the divisive effect this issue had on our small community pitting urban against rural, with the rural residents, mainly ag producers, supporting stricter controls.

It also illustrates the distinction that many of us in agriculture make between this new model of livestock production and the family farm model that is traditional in our rural communities, and that I still believe is the most sustainable for our rural communities.

I call these new operations "factory farms" to distinguish them from traditional family farms. When neighboring landowners challenged a huge pork feeding facility in Grand Forks County, North Dakota, District Judge Bruce Bohlmann hit the nail on the head when he said the facility was "not a farming operation" but a "pig factory."

This term refers to the model of production only. I do not use it as a negative term to pass judgment on the individual owners or farmers who are developing these large-scale farming operations. I know that there are many responsible, conscientious farmers who work diligently to prevent their factory farming operations from having the environmental consequences that my neighbors and I are so concerned about. However, I also know that, regardless of these efforts by some factory farm operators, these operations inherently have impacts and pose risks that traditional family farms do not.

For this reason, factory farms have become an extremely polarizing issue in our rural communities as an aging population of farmers struggles to provide financially successful options to bring young farmers back to rural areas, while weighing the inherent impacts and risks of the factory farm model of production.

The factory farm model is often promoted and presented as an essential shift for the future of our rural economy, and the logical next step in the modernization and industrialization of agriculture. It is, in fact, bringing with it a host of new concerns, never before presented by traditional family farms. Communities are suddenly dealing with regulating and permitting operations that are touted as agriculture, when in fact, they are more similar to industrial production facilities than traditional family farms.

The reality is that factory farms have proven to have many unanticipated consequences to clean air, pristine landscapes, precious water resources, and the high quality of life that sets our rural communities apart. What's more, the promises of jobs, income and prosperity remain largely unfulfilled.

The unplanned, unregulated expansion of these operations threatens the very communities that their proponents claim they will enhance, yet they have expanded dramatically over the past 30 years, and are continuing to do so.

- South Dakota Ag statistics show that by 2002, our State lost more than 80 percent of the dairy farms and more than 83 percent of the hog farms that were operating in 1982. However, over the same time period, we only lost 20 percent of our hogs and half of our dairy cows. In other words, South Dakota's remaining dairy farms are two and a half times larger than they were 25 years ago, and our hog farms nearly five times larger than they were 25 years ago.
- In Iowa the average inventory of hogs per farm increased from 250 in 1980 to 1,430 in 2000—over five times larger.
- In Missouri, while the total number of hogs stayed the same, the average size of an operation grew from 180 in 1985 to 1,227 in 2005—nearly seven times larger.

This shift in farming methods is recent and far-reaching enough to have swamped many local and State governing bodies with ballooning costs to school districts, road maintenance, and environmental costs.

Townships, counties and even states across the Nation are struggling to handle these impacts. Many have established moratoriums as they attempt to put into place adequate, comprehensive laws and regulations to protect their citizens, natural resources, and their quality of life from the unintended and often accidental consequences of factory farm development.

Hyde County, South Dakota, is not unique in setting tough standards for factory farms. Throughout the network of WORC chapters in seven western states, we can point out numerous examples of agricultural leaders and communities standing up to the industrial scale feedlots and attempting to protect their natural resources and quality of life.

In Hyde County and elsewhere, we are protecting our local environment, but stronger State and national rules are needed. Pollution doesn't know or care about State lines. While we in Hyde County have tried to protect our local environment, we also knew that we couldn't protect ourselves from manure spills in counties upstream with a county zoning ordinance. Water, creeks and for that matter manure run downhill and don't respect county or State lines.

I understand that there are proposals to exempt factory farms from some of our Federal environmental laws, and I urge you to oppose these efforts, and to preserve the clean air and water standards we have for factory farms and all of agriculture, as well as those that ensure that toxic waste sites are cleaned up, and that the public is given information about emissions of pollutants and contaminants.

As a farmer and rancher, I do not feel threatened by these laws, and I do not believe that any factory farm operator need fear them either. They are not designed to punish responsible farmers of any size or type, and I am not aware of a single instance when they have been used to do so.

These laws were designed to insure the health and well-being of my family, my land, and my downstream and downwind neighbors. Today more than ever, we need to maintain and even strengthen them to protect the communities in which factory farms are operating. If factory farm operators are going to manage large numbers of livestock in small, confined units, let them do so by internalizing the full costs of their operations by managing and treating the wastes, and containing harmful emissions, and by receiving an appropriate penalty if they fail to do so.

Thank you.

Senator BOXER. Thank you, sir.

Dr. Dicks from Oklahoma State University, welcome.

STATEMENT OF MICHAEL DICKS, OKLAHOMA STATE UNIVERSITY

Mr. DICKS. Good afternoon. My name is Mike Dicks, and I am a professor of agricultural economics.

Thank you. I want to thank the Committee for holding this hearing and for providing me with an opportunity to provide input.

I provided written testimony to include in the record and want to focus my time here on just a specific few points. I listened to the comments this morning, and I think these points are interesting to be sure.

My main point is that we need to stop dealing with the waste, with animal manure as a waste and start dealing with it and viewing it as a natural resource, as a valuable natural resource. By treating it as a waste, we have employed all efforts and resources to contain and eliminate rather than collect and utilize.

The animal industry implements the best manure management strategies provided by public and private research efforts. To demand that an industry continue to adopt cost-effective BMPs is not unreasonable, but to be unhappy with the result of that implementation and then pose new regulations or restrictions on the industry without either the available technologies or financial ability to implement those technologies would seem unreasonable.

I also don't know of a single study that has actually measured the benefits and the costs of implement known BMPs in the Nation's CAFOs. Few studies have attempted to evaluate the benefits and costs of discharge abatement in specific watersheds and most are loaded with assumptions where scientific data is unknown or uncertain. For the most part, Federal, State and local actions have been taken to contain and eliminate animal manure under the assumption that the damages, real or perceived, exceed the abatement costs.

Environmental regulation of CAFOs should only impose costs where the value of corresponding benefits is greater. Considering all available abatement technologies, only those that have the costs for specific operations where the value of corresponding benefits is greater should be implemented. Otherwise, individuals, communities, regions and societies have lower welfare than before the abatement technologies were implemented.

Most States are implementing animal manure and water quality standards that exceed those established in Federal law. We have heard that this morning.

These tighter standards are in response to environmental conditions unique to specific area and the public's perception of problems. Certainly, Oklahoma is no exception and has been actively engaged in addressing air and water quality concerns associated with animal manure

The current focus of BMPs is on containment and elimination. The most obvious forms of containment are manure ponds, lagoons and holding pits.

Examples of successful alternative manure management strategies that stress collection and utilization include the Mason-Dixon Dairy in Gettysburg, Pennsylvania, S&S Aqua Farms in West Plains, Missouri, the Solar Aqua Farms in Sun City, California, and there are many more that I could list.

These farms incorporate animal manure into a production system to produce energy, fertilizer, chemical-free quality food, bedding and fresh water. These are all examples of farms that have moved from monoculture production schemes to multiple product systems. These farms have incorporated animal manure into the production process. They collect and utilize.

There are many of these new types of farming systems developing throughout the world, but they are still far outside the mainstream thinking.

In addition, considerable research efforts are underway at private and public universities and businesses. Some examples of these research thrusts include improving nutrient content of foods and better animal genetics to reduce the total quantity of manure, new collection systems to move manure from feed pens to storage facilities and new storage facilities that actively process manure for incorporation into new products.

On average, CAFOs have funds available for the adoption of new technologies. However, the amount of funds in a given year are highly variable. Because of the return to investment in these operations are often below the returns to limited risk investments, the decision to implement new technology in these operations is frequently not a good business decision.

The contain and eliminate paradigm has led to environmental issues of great concern to those individuals and communities near and downstream from the animal feeding operations. In response, new State and Federal Government regulations have been promulgated to address these concerns and have not, as yet, been fully implemented.

The new regulations require many operations to make major investment in plant or operational changes that are not part of their original operation plans. We are currently unsure of the costs of implementing these strategies is exceeded by the benefits of doing so.

BMPs developed to incorporate animal manure into food and fuel production may provide added benefits and increase the economic feasibility of both private and public support of adoption. CAFO initial operation plans contain the best technologies of the time. As we learn more about how animal manure interacts with the environment through different operations and unique ecological systems, the best management practices today will be changed.

The animal feeding operations have limited funds to incorporate new technology and, of course, technological economies of size exist in this industry. Thus, a requirement to adopt new technologies puts a greater burden on smaller operations. In response to financial constraints, Federal and State Government have provided cost-share assistance and adequate timelines and consideration for financial burden.

The industry is engaged in developing nutrient management plans and implementing BMPs, but these efforts won't be fully realized for several years. After full implementation of the new EPA National Pollutant Discharge Elimination System permitting requirements and Effluent Limitations Guidelines and Standards rule, we can revisit the environmental concerns related to animal feeding operations and determine a future course of action.

However, until we change to a paradigm of collect and utilize, we will never fully address the issues surrounding animal manure.

Thank you for your time, and I will be open to questions.

[The prepared statement of Mr. Dicks follows:]

STATEMENT OF MICHAEL DICKS, OKLAHOMA STATE UNIVERSITY

Animal manure management has always been a major component of the design and operation of confined animal production facilities but has certainly increased in importance over the last 30 years. I have been involved with animal production and manure utilization for more than 35 years and been part of the design and implementation of manure utilization technologies in the U.S. and Africa. I am currently a Professor of Agricultural Economics at Oklahoma State University and specialize in the areas of agricultural policy and farm and ranch management. The issues surrounding animal manure are important and I thank the Senate Public Works and Environment Committee for holding this hearing and providing me the opportunity to bring a new perspective to the debate on animal manure management. I am going to focus my remarks on public and private efforts too minimize the adverse impacts of animal manure on human health and the environment.

Oklahoma has 799 registered poultry feeding operations, 220 licensed confined swine feeding operations, 66 licensed confined cattle feeding operations and 12 licensed confined dairy operations. These represent only those operations with actual or potential discharge that are large enough to be required to be licensed or registered under current State or Federal statues and thus there are certainly more animal feeding operations in the state. These Animal Feeding Operations (AFOs) are spread throughout the State but tend to be lumped by species in specific regions of the state.

Oklahoma also contains approximately 11,611 miles of shoreline, (slightly less than the estimated combined general coastline of the Atlantic, Gulf, Pacific, and Arctic Coasts) and approximately 78,578 miles of rivers/streams. From 1996 through 2007 roughly 1,000 complaints have been received by the Oklahoma Department of Agriculture Food and Forestry (ODAFF) related to animal manure concerns from cattle, swine, horse, rabbit, poultry, goat, and dog confined production operations. These complaints dealt with potential or actual water quality problems, odor, dust and noise.

The combination of abundant AFOs, number of water bodies and concerned citizens in Oklahoma provides an excellent opportunity to study the interaction of the three. To assert there are no problems in animal manure management in the State of Oklahoma would be nothing short of ridiculous, but to assume that the owners of livestock production, feeding and processing firms are not actively engaged in pursuing changes to meet new standards and implement the latest "Best Management Practices" (BMPs) would also be ridiculous. The management of animal manure is just one complicated issue in a very complex industry. Few understand either and even fewer understand both.

My main message is the need to change from dealing with animal manure as a waste and place more focus on fully utilizing this valuable resource through greater support of research and development. By treating manure as a waste we employ all efforts and resources to contain and eliminate rather than collect and utilize. We seem to have abandoned this resource, valuable for energy and food production, in favor of other less efficient sources such as chemical fertilizers and ethanol. The demand for cheap food and international competition from countries with cheaper capital assets has induced the proliferation of the large CAFOs over the last four decades. These facilities were initially constructed to efficiently provide abundant and cheap sources of animal protein with little thought toward their combined environmental impact. As we have become aware of this impact the industry has changed and devoted a considerable amount of their net earnings to meeting the problem. The industry has and continues to implement the strategies provided by public and private research efforts. To demand that an industry continue to adopt cost effective BMPs is not unreasonable but to be unhappy with the result of implementation of these BMPs and then pose new regulations or restrictions without either the available technologies or the financial ability to implement those technologies is unreasonable. And, the continued promulgation of new regulations here and not abroad will eventually shift the industry abroad.

Some view regulation and litigation as the answer to problems and others seek innovation and incentives. Solutions that are profitable and adaptable will be readily adopted by industry. These facts support the idea that our scarce resources are best spent not on forcing change through regulation and litigation but rather inducing change through research and education.

DO WE NEED NEW CAFO REGULATIONS?

The purpose for this hearing is to address the impacts of CAFOs on human health and water quality to determine the need for increased regulation in an attempt to mitigate any adverse impacts from animal manure. The nutrients in animal manure have found their way into natural waters and the odor and dust from CAFOs has found its way into the air we breathe. However, I do not know of a single study that has actually measured the benefits and costs of implementing known BMPs in the nations CAFOs. Few studies have attempted to evaluate the benefits and costs of discharge abatement in specific watersheds and most are loaded with assumptions where scientific data is unknown or uncertain. For the most part, Federal, State and local actions have been taken to contain and eliminate animal manure under the assumption that the damages, real or perceived, exceed the costs. In theory, environmental regulation of CAFOs should only impose costs where the value of corresponding benefits is greater. In considering all available abatement technologies, only those that have costs for specific operations, where the value of corresponding benefits is greater should be implemented. Otherwise, individuals, communities, regions and society have lower welfare than before the abatement technologies were implemented. To impose this restriction would end the debate pending a benefit/cost assessment. However, to move us beyond this point we will assume that the implementation of nutrient management plans that choose from amongst a set of best management practices is accomplished such that the costs do not exceed the benefits of this implementation.

To induce a change in current behavior we can employee either the stick or the carrot approach. In terms of Federal policy, we have used, and continue to use both approaches. The most commonly known carrot approaches include technical and cost-share assistance, subsidies and the less commonly included approaches of research and education. On the stick approach we have Federal, state, and local regulations, taxes, and permits that pose constraints on behavior. In either the stick or the carrot approach there are two conditions required to induce or force behavior change. First, there must be clear, cost effective alternatives to current behavior and second the targeted party must have the ability to adopt the alternatives. Of course this presumes that with respect to the CAFOs, we wish to change their behavior regarding manure management rather than eliminate them all together. If the purpose of the debate regarding the further regulation of CAFOs is an indirect attempt to deal with issues of structure in the animal production and processing industry then I would submit that the attempt is misguided and likely to lead to more concentration rather than less.

Current Efforts—Most states are implementing animal manure and water quality standards that exceed those established in Federal law. These tighter standards are in response to environmental conditions unique to areas within the state. Certainly Oklahoma is no exception and has been actively engaged in addressing issues specific to air and water quality concerns resulting from animal manure. For instance;

- In 1998, the Oklahoma USDA-NRCS revised their Conservation Practice Standard, Waste Utilization (Code 633), with a provision specifically for the Eucha/Spavinaw Watershed to restrict poultry litter application on land with a phosphorus index of 300 lbs/acre or greater.
- In 2000, the Oklahoma Water Resources Board required poultry producers in nutrient limited watersheds and nutrient limited groundwater areas to test their soil prior to litter application every year, rather than every 3 years as is required for non-nutrient limited watersheds.
- In 2001, the Oklahoma USDA NRCS published the Nutrient Management standard (Code 590), replacing the Waste Utilization (Code 633) standard from 1995 and 1998. The new standard made phosphorus, rather than nitrogen, the limiting factor in all nutrient management plans. In non-nutrient limited watersheds, the phosphorus index has an upper limit of 400 lbs/acre, after which no additional litter may be applied. In nutrient limited watersheds, 300 lbs/acre is the threshold. The standard is applicable statewide.[1]
- The Food Security and Rural Investment Act of 2002 extended and expanded funding for the Environmental Quality Incentives Program (EQIP). The program called for 60 percent of funding to be spent on livestock operations. In order to reach this goal, NRCS has developed the National Animal Agriculture Conservation Framework (December 2003). This National Framework is built from State and Basin Area efforts and presents a vision for voluntary, proactive efforts to foster environmentally sound and economically viable livestock and poultry production. It envisions collaboration among Federal, State, tribal, and local governments; producers; the public; and the private sector to bring the initiative, resources, and commitment to support environmental stewardship in animal agriculture.
- In 2003, The Office of the Secretary of Environment issued a Coordinated watershed Restoration and protection Strategy for Oklahoma's Impaired Scenic Rivers".
- In 2003, Oklahoma and Arkansas signed a "Statement of Joint Principles and Actions," outlining how the states would work together to improve water quality in Oklahoma's scenic rivers. The pact calls for "The states of Arkansas and Oklahoma, acting through their environmental agencies, to work together in partnership with the Arkansas-Oklahoma Arkansas River Compact Commission toward the goal of producing a Watershed Plan.
- In 2007, Oklahoma signed a $20.6 million cooperative conservation partnership agreement between USDA and Oklahoma that will create up to 9,000 acres (or 370 miles) of riparian buffers and filter strips under the Conservation Reserve Enhancement Program or CREP.

In 2005 and 2006 NRCS spent just over 60 percent of the EQIP funds on livestock operations but less than 20 percent on CAFOs. However, the 20 percent includes transportation subsidies and other cost-share assistance not directly tied to changes in the operation of the CAFOs. This is important as the impacts of animal manure more frequently occur at the land applicationsite than at the CAFO. With both the Oklahoma CREP and EQIP, funds have been targeted to produce buffers and filter strip and to fence livestock out of these areas. Because phosphorous readily attaches to soil particles most phosphorous contamination of water is the result of soil erosion. Reducing this erosion or reducing the ability of eroded soil particles from entering the water will reduce phosphorous induced water quality degradation. These fenced buffers and filter strips offer the additional benefits of wildlife nesting habitat and stockpiled forage for emergency use.

[1]Note that there is no scientific basis for this phosphorus constraint. No upper limit on phosphorus has been found that limits plant growth potential.

Environmental Quality Incentives Program FY-2005
Cost-Share Approved by Livestock Type

Livestock Type	Total Cost-Share Approved	Confined Cost-Share Approved	Unconfined Cost-Share Approved	Practices Undistinguishable Cost-Share Approved	Number of Contracts
Sheep	$8,883,826	$1,184,029	$2,707,934	$4,991,863	508
Beef	$327,827,898	$52,489,151	$88,672,588	$186,666,159	20,539
Dairy	$91,143,643	$65,057,371	$4,266,626	$21,819,646	2,517
Other	$18,867,510	$3,069,111	$6,023,959	$9,774,440	1,227
Poultry	$32,524,429	$28,154,447	$921,553	$3,448,429	1,789
Swine	$17,582,432	$13,718,812	$162,807	$3,700,813	883
Subtotal	**$496,829,738**	**$163,672,921**	**$102,755,467**	**$230,401,350**	**27,463**
Non-Livestock	$297,430,838	$0	$0	$0	21,943
Total	**$794,260,576**	**$163,672,921**	**$102,755,467**	**$230,401,350**	**49,406**
Source: Protracts FY2005 04OCT05					

Environmental Quality Incentives Program FY-2006
Cost-Share Approved by Livestock Type

Livestock Type	Total Cost-Share Approved	Confined Cost-Share Approved	Unconfined Cost-Share Approved	Practices Undistinguishable Cost-Share Approved	Number of Contracts
Sheep	$6,552,097	$701,466	$2,246,764	$3,603,867	296
Beef	$312,634,324	$43,062,776	$71,465,241	$198,106,306	17,605
Dairy	$90,101,196	$62,284,196	$3,372,295	$24,444,705	1,951
Other	$20,410,903	$3,198,336	$6,526,001	$10,686,566	1,118
Poultry	$28,478,004	$23,036,577	$629,270	$4,812,157	1,252
Swine	$25,570,331	$20,116,235	$327,272	$5,126,824	658
Subtotal	**$483,746,854**	**$152,399,586**	**$84,566,843**	**$246,780,425**	**22,880**
Non-Livestock	$304,220,696	$0	$0	$0	18,310
Total	**$787,967,550**	**$152,399,586**	**$84,566,843**	**$246,780,425**	**41,190**
Source: NRCS Protracts 10 07 2006					

In Oklahoma, about 16 percent of the 2006 EQIP funds were spent on storage, composting, sprinkler systems and other practices for CAFOs and another 8 percent was spent on transport and application of manure. Another large portion of the funds were used to produce and fence buffers and filter strips.

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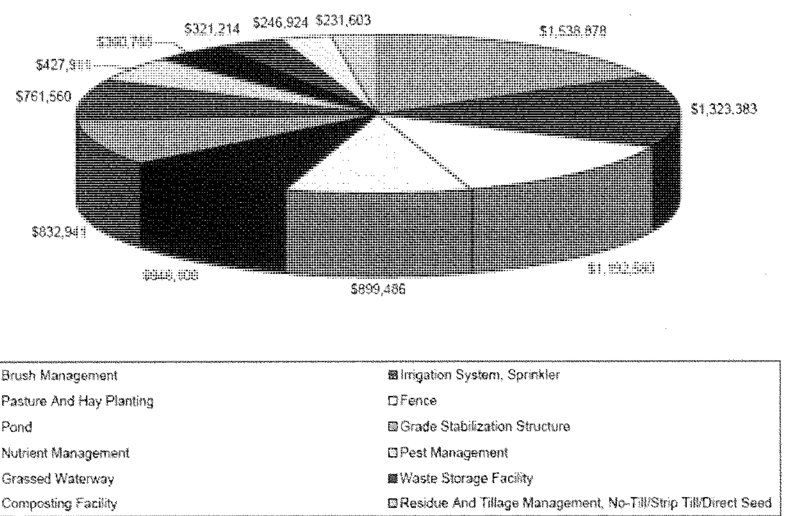
EQIP 2006
Top 12 Practices Applied

EQIP provided cost-share for 7,577 practice installations of 54 distinct practices across Oklahoma in 2006. Total cost-share provided was $11.3 million. This chart summarizes the top 12 practices, which account for nearly $9 million or 80% of the total.



Source: USDA/NRCS

These actions represent a timeline of involvement of CAFO operators, state and federal agencies, and conservation and community groups in an attempt to pursue solutions to local water quality problems posed by animal manure. Also important are the education, research and extension efforts of the state agencies and Oklahoma Agricultural

Source: USDA/NRCS

These actions represent a timeline of involvement of CAFO operators, State and Federal agencies, and conservation and community groups in an attempt to pursue solutions to local water quality problems posed by animal manure. Also important are the education, research and extension efforts of the State agencies and Oklahoma Agricultural Experiment Station in addressing animal manure issues. This is not an exhaustive list of all the activities of Federal, state, and local governments, community groups and private and public research and education efforts dealing with CAFOs in this decade. To list all these efforts would fill several hundred pages. But these efforts symbolize the engagement of the industry and community in dealing with manure management issues.

Clearly, CAFOs are actively implementing the nutrient management practices as per the NRCS technical guides. The EQIP practices are provided with 50–75 percent cost share and the transportation subsidies of $4 to $12.50/ton depending on the distance between production and use sites. Current farm bill proposals however, seek to reduce eligibility to EQIP cost share assistance based on producer's gross income. As I will show later, because of the low profit margins in many animal feeding operations (particularly cattle) large gross incomes are needed. The cost ?shared practices that NRCS provides through EQIP are frequently part of other changes that must be implemented simultaneously. Thus, the total cost of implementing the practice often exceeds the cost-share. Restrictions on payments based on income will reduce the ability of EQIP to induce change.

ARE THERE CLEAR ALTERNATIVES?

The current emphasis is on containment and elimination of animal manure from animal feeding operations. The most obvious forms of containment are the manure ponds, lagoons, and holding pits for manure storage and the elimination through land application. Increased efficiency in land application would alone solve many of the water quality issues. But as I stated previously the current paradigm of contain and eliminate is at the core of the problem. Are there alternatives for collection and use?

This question can be broken into 1) are the technologies available and 2) can they be implemented. Let's first consider whether there are clear alternatives to current behavior.

The U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) is charged with providing technical assistance to agribusiness to both improve production and minimize the impacts of the production activities on the environment. The NRCS has been active in assisting animal agricultural by providing technical guides for every type of production agriculture. With respect to the CAFOs, the USDA/NRCS has a national technical guide for developing a comprehensive nutrient management plan. According to the NRCS National Planning Procedures Handbook (Subpart B, Part 600.51 Draft Comprehensive Nutrient Management Planning Technical Guidance) "a CNMP is a conservation plan that is unique to animal feeding operations. It is a grouping of conservation practices and management activities which, when implemented as part of a conservation system, will help to ensure that both production and natural resource protection goals are achieved. A CNMP incorporates practices to utilize animal manure and organic by-products as a beneficial resource. A CNMP addresses natural resource concerns dealing with soil erosion, manure, and organic by-products and their potential impacts on water quality, which may derive from an AFO. A CNMP is developed to assist an AFO owner/operator in meeting all applicable local, tribal, State, and Federal water quality goals or regulations. For nutrient impaired stream segments or water bodies, additional management activities or conservation practices may be required to meet local, tribal, State, or Federal water quality goals or regulations."

Many States have their own set of BMPs that are more restrictive, have been in place longer, and provide their own programs to assist in implementation. As we have more experience with the management of animal manure in the various feeding structures, in unique environments these BMPs may change. A list of common list of BMPs is provided below, divided into four categories, covering a specific operation or management task: grounds, buildings, lagoons, settling basins and holding ponds, and land application[2].

[2] http://www.epa.state.il.us/water/cafo/publications/pork-bmp.pdf

Grounds—BMPs involving the grounds at pork production facilities are basically common sense and being considerate of your neighbors. Below are examples of BMP activities that you may be able to implement at your facility:

- locating the facility as far as possible from surface water bodies
- locating the facility in an area with sufficient soil drainage
- having wind breaks and buffer strips around the facility
- diverting rain water away from areas where it could become contaminated
- maintaining proper gravel cover and landscape gradient so that water does not stand in access roads and around the production facility
- scraping away manure in open feed lots to reduce buildup of solids and to control odor and fly production
- collecting runoff from lots through settling basins for subsequent land application
- immediately loading manure into a manure spreader and directly applying to the field
- removing spilled feed promptly
- keeping feeder equipment in good repair
- keeping watering devices in good repair

Buildings—Routine maintenance and good housekeeping practices are the two easiest ways to prevent pollution in buildings. Some ways that you can use BMPs in buildings are:

- constructing interior surfaces with smooth materials to reduce dust and grime accumulation and facilitate cleaning
- maintaining adequate ventilation in the building to prevent buildup of dusts, gases, moisture and heat
- preventing liquids from collecting under animals and watering equipment by using slotted floors or other technologies
- repairing leaking water lines immediately
- maintaining clean and dry buildings
- installing an under floor ventilation system in confinement buildings where below floor manure storage is used
- using a power washer when hosing down walls, dividers and floors in order to reduce water usage
- covering feeders and extending feed downspouts to minimize dust
- scraping off or flushing away manure in confinement areas on a frequency which is adequate to minimize odors
- covering sumps at lift stations
- pumping manure from accumulation areas to storage areas on a frequency which is adequate to prevent odors and overflow

Lagoons, settling basins and holding ponds—Undersized or poorly designed lagoons, settling basins and holding ponds can cause pollution. Below are some examples of ways to improve your lagoons, settling basins and holding ponds:

- locating lagoons, settling basins and holding ponds away from valleys which can trap odors in low lying areas
- constructing lagoons, settling basins and holding ponds so that wastes do not overflow or leach into groundwater and so that odor is minimized
- covering the lagoon, settling basin or holding pond to reduce surface odors being released
- adding aeration
- pumping or draining manure to a lagoon in small enough quantities to avoid slug loadings, maintaining a stable microbial population within the lagoon
- maintaining sufficient storage capacity to prevent overflow of lagoons, settling basins and holding ponds
- using a pump and a solids separator to lower solids loading
- removing sludge from the primary lagoon frequently enough to prevent overloading or carryover of solids to a second stage lagoon
- equipping lagoons and holding ponds with a free board gauge that shows when it is time to pump out and land apply supernatant, preventing overflows
- dewatering lagoons only down to the minimum treatment volume level as indicated on the lagoon marker
- filling new or emptied lagoons with water to the minimum treatment level before manure is introduced

Land application—Manure as a fertilizer can be environmentally beneficial. However, there are additional opportunities for reducing pollution when applying the manure to the land. Some examples of BMPs in land application practices are:

- developing a manure management plan
- scheduling application times that are compatible with crop rotations

• having sufficient land available to apply during various times of the year so that the rate of application will be at or below agronomic rates
• applying manure early in the morning until early afternoon
• applying manure on days with low humidity and little or no wind
• applying manure at a site remote for neighboring residences if manure is not injected or immediately incorporated into the soil
• applying manure on land which is not frozen or snow-covered
• preventing contaminated runoff by not applying manure to land which is saturated or contains ponded water
• preventing contaminated runoff by not applying manure near a creek or river
• preventing contaminated runoff by not applying manure during precipitation or when precipitation is imminent
• injecting manure
• determining the necessary application rate and properly calibrating your equipment
• using injection equipment which leaves crop residue intact and creates a level surface to plant crops without further tillage
• applying liquid waste at low pressure with little agitation if spreaders or sprayers are used to land apply
• fixing leaks in over-the-road manure hauling equipment and cleaning tillage equipment used to incorporate manure if travel on public roads is necessary

This list is both complete and reflective of the current "contain and eliminate" manure management paradigm. This list is what the industry is being asked to implement and is engaged in implementing. However, there are other less known alternatives and research is underway to minimize the amount of nutrients in the manure and the quantity of manure, transportation and storage of manure, and more efficient utilization of the manure in the production of alternative products from fuel to food. Examples of successful alternative manure management strategies include the Mason-Dixon Dairy in Gettysburg, Pennsylvania, S&S Aqua farms in West Plains, Missouri and the Solar Aqua Farms in Sun City, California.

The Mason-Dixon operation produces 80,000 quarts of milk daily from over 2,000 cows, designs and manufacturers its own innovative equipment, producing energy, fertilizer and bedding from the dairy cow manure in a nearly self contained operation.

Solar Aqua Farms raises 5 million pounds of tilapia in the middle of the desert, in tanks under greenhouses. A patented treatment and recycling system purifies the water and converts fish waste to organic fertilizers. The process was developed from efforts to turn human sewage into edible outputs and fresh water.

S&S Aqua farms also uses a closed cycle, self balancing system and the natural nutrients from a biological source to grow safe, chemical-free, quality food.

These are all examples of farms that have moved from monoculture production schemes to multiple product systems. These farms have incorporated animal manure into the production process— "collect and utilize". There are many of these new types of farming systems developing throughout the world but they are still far outside mainstream thinking.

In addition, considerable research efforts are underway at private and public universities and businesses. Some examples of these research thrusts include;

• Improving nutrient content of feeds (e.g. high oil corn) and better animal genetics will reduce the total quantity of manure while improved feed additives may enable more efficient uptake of feed nutrient.
• New collection systems to move manure from feed pens to storage facilities.
• New storage facilities that actively process manure for incorporation into new products (e.g. feed, fertilizer, soil additives, fuel)
• Use of manure as an input into fuel production (e.g. heat, methane, ethanol), food production (e.g. aquatic plants and animals, land based crops)

Prior to the 1980's research in all these areas received a great deal of Federal support but today are almost exclusively funded through private industry. Currently, some $7.5 billion is provided to the ethanol industry through the $0.52 per gallon ethanol subsidy. Perhaps this level of funding on manure management could also induce more efficient use of the resource.

CAN THE ALTERNATIVES BE IMPLEMENTED?

The animal feeding industry is actively seeking new technologies for manure management and use, and implementing the currently available BMPs. However, they face financial constraints in the adoption of new technologies.

Livestock producers typically exhibit extremely high levels of gross profitability although recent increases in energy and feed prices has severely reduced the profitability of poultry and hog production enterprises. Except in drought areas beef and dairy producers have been somewhat successful in maintaining high levels of gross profitability through the substitution of forage for feed. Gross profitability, defined as cash sales less cash expenses divided by cash sales (profit margin) has been consistently maintained at 15–30 percent from 2000 to 2005. However, because the amount of sales generated per dollar of fixed assets has been low (due to land prices), the return on investment has been low relative to other businesses with equal risk.

The beef feedlots, poultry processors and other similar downstream agribusinesses tend to have similar returns on investment. However, the low return on investment is the result of low profitability and high rates of sales per dollar of assets (Asset Turnover). The return on investment represents the potential income available to management for salaries and new investment, the funds available for constructing new structures and adopting new practices. The numbers provided below are averages and do not reflect the variation between years or within the industry. For example, the typical 30,000 head feedlot had losses of nearly $1 million and profits of $600 thousand over a 10 year period from 1997 to 2006. Poultry production operations had negative incomes over the last 2 years as a result of the high energy costs associated with heating and cooling and higher than normal feed costs.

	S/FA	GPOCR	ROI
Feed Grains	$0.39	15.6%	6.1%
Wheat	$0.26	28.1%	7.3%
Cotton	$0.59	7.9%	4.7%
Rice	$0.44	-3.4%	-1.5%
Dairy	$0.42	18.2%	7.6%
Beef	$0.17	21.7%	3.7%
Poultry	$0.18	31.4%	5.7%
Feedlot	$2.17	1.2%	2.6%
Poultry Processor	$2.53	2.7%	6.8%

S/FA is the dollar of sales per dollar of fixed assets
GPOCR is the profit margin
ROI is the pre-tax percent of total income available to the owner for management and capital

Thus, while some funds are available for the adoption of new technologies, the amount of funds in a given year are highly variable and will reduce ownership's income. Because the return to investment is often below the returns to limited risk investments such as Certificate of Deposits, the decision to continue the operation is frequently not a good business decision but rather a decision that includes non-business factors such as desired lifestyle. Increased regulations that required the adoption of costly new technologies may lead to a relocation of the firm (to avoid the regulations) or exit from the industry. In most cases the exit is by smaller firms less able to spread the cost of new technologies over larger numbers of production units. The smaller operations assets are then acquired by larger firms, increasing industry concentration.

SHOULD NEW REGULATIONS BE IMPOSED?

The Environmental Protection Agency (EPA) (Final rule: 40 CFR Parts 122 and 412) extended certain compliance dates in the National Pollutant Discharge Elimination System (NPDES) permitting requirements and Effluent Limitations Guidelines and Standards for concentrated animal feeding operations (CAFOs) as a result of the decision of the U.S. Court of Appeals for the Second Circuit in Waterkeeper Alliance et al. v. EPA, 399 F.3d 486 (2d Cir. 2005).

The final rule revised the dates established in the 2003 CAFO rule by which facilities;

- newly defined as CAFOs
- defined as CAFOs after April 14, 2003, due to operational changes
- and permitted CAFO's required to develop and implement NMPs

must seek permit coverage and develop and implement their nutrient management plans from July 31, 2007, to February 27, 2009

Major changes made by EPA in its revised CAFO Rule include:

- All large CAFOs must apply for an NPDES permit, or demonstrate that they have no potential to discharge into waters of the United States.
- Large poultry operations using dry waste management systems are now covered by the CAFO Rule.
- New source poultry, swine, and veal operations, as defined by EPA in the Rule, must meet a "no discharge" standard. This standard only allows for discharge from the production area in the event of a 100-year, 24-hour storm or greater.

EPA proposed to require only owners or operators of those CAFOs that discharge or propose to discharge to seek authorization to discharge under a permit. Second, EPA proposed to require CAFOs seeking authorization to discharge under individual permits to submit their NMPs with their permit applications or, under general permits, with their notices of intent. Permitting authorities would be required to review the NMP and provide the public with an opportunity for meaningful public review and comment. Permitting authorities would also be required to incorporate terms of the NMP as NPDES permit conditions.

This rule follows the 1999 USDA/EPA United National Strategy for Animal Feeding Operations. This National Strategy is based on a national performance expectation that all Animal Feeding Operations should develop and implement technically sound, economically feasible, and site-specific CNMPs to minimize impacts on water quality and public health.

This regulation requires that CAFOs have NMPs in place by 2009 and that these NMPs will incorporate the best management practices as indicated in the NRCS National Technical Guide. Thus, by 2009, CAFOs will have plans in place for implementing best available technology.

Some have suggested that we move animal manure under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Will this improve upon the results obtainable under the EPA NPDES rule?

CERCLA Overview:

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Over 5 years, $1.6 billion was collected and the tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites.

CERCLA:

- established prohibitions and requirements concerning closed and abandoned hazardous waste sites;

• provided for liability of persons responsible for releases of hazardous waste at these sites; and

• established a trust fund to provide for cleanup when no responsible party could be identified.

The law authorizes two kinds of response actions:

• Short-term removals, where actions may be taken to address releases or threatened releases requiring prompt response.

• Long-term remedial response actions, that permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions can be conducted only at sites listed on EPA's National Priorities List (NPL).

CERCLA also enabled the revision of the National Contingency Plan (NCP). The NCP provided the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL.

Does the suggestion to move animal manure under CERCLA mean that a tax will be levied on the animal feeding industry, the animal industry, or agriculture in general? Do the proponents of this move intend that we fund the oversight agency with personnel sufficient to define manage each CAFO in the United States as a hazardous waste site?

Are we prepared to fund the economic assessment of implement such a far reaching policy as required by statute? While the answers to these questions are important to determine the feasibility of redefining animal manure as a hazardous material, that fact that we already have regulations that have yet to be fully implemented makes the questions moot.

SUMMARY

The fact that we are here today discussing the animal manure issue conveys the importance of the issue. Animal manure has too long been treated as a waste to be contained and eliminated rather than as a valuable resource that should be collected and utilized. The "contain and eliminate" paradigm has led to environmental issues of great concern to those individuals and communities near and downstream from the animal feeding operations. In response, State and Federal Government regulations have been promulgated to address these concerns and have not as yet been fully implemented.

The new regulations will require many operations to make major investments in plant and operational changes that were not part of the original operation plans. We are currently unsure if the costs of implementing these strategies is exceeding by the benefits of doing so. BMPs developed to incorporate animal manure into fuel and food production may provide added benefits and increase the economic feasibility of both private and public support of adoption.

CAFO initial operation plans contained the best technologies of the time. As we learn more about how animal manure interacts with the environment through different operations and in unique ecological systems, the best management practices of today will be changed. The animal feeding operations have limited funds to incorporate new technology and of course technological economies of size exist in the industry. Thus, requirements to adopt new technologies puts a greater burden on smaller operations. In response to financial constraints Federal and State governments have provided cost-share assistance and adequate timelines and consideration for financial burden.

The industry is engaged in developing NMPs and implementing BMPs but these efforts won't be fully realized for several years. After full implementation of the new EPA National Pollutant Discharge Elimination System (NPDES) permitting requirements and Effluent Limitations Guidelines and Standards rule we can revisit the environmental concerns related to animal feeding operations and determine a future course of action. However, until we change to a paradigm of collect and utilize we will never truly address the issues surrounding animal manure.

Senator BOXER. Thank you, sir.

Our last speaker is Rick Dove who is a community representative from North Carolina, who works as a volunteer for Waterkeepers is my understanding, and other clean water organizations.

Welcome, sir.

STATEMENT OF RICK DOVE, COMMUNITY REPRESENTATIVE

Mr. DOVE. Thank you, Madam Chairwoman and Committee members. It is a pleasure to be here today.

I am from North Carolina. I am here, as you stated, as an individual representing my family, my grandchildren and the many citizens of North Carolina who share my thoughts on the matter before this committee.

When I retired from the Marine Corps in 1987, I walked out the front gate of Camp Lejeune, North Carolina and headed for my home on the Neuse River in North Carolina just below New Bern. I immediately traded my uniform and spit-shined shoes for a pair of waterman's boots and some old clothes. Then, with my son, Todd, I became a waterman, a fisherman, on the Neuse River.

It was a childhood dream that I had to be a fisherman. For the first few years on the Neuse, things were fine. We were having a great time. My son and I owned a seafood store, three boats and 800 crab pots; life was good.

Then, all of sudden, things changed. The fish began to die. My son and I began to get sick. We had sores on our bodies. I began to suffer memory loss. We didn't know at the time that all of what was happening to us was attributed to working on the river, but we knew was not healthy.

My dream had turned into a nightmare. We had to walk away from the seafood business.

During the next 8 years, the environmental transition in North Carolina was dramatic. In 1991, 1 billion fish in a 40-square-mile area died in the Neuse River. Most had open, bleeding sores all over their bodies. Pictures of this are in my written statement, a copy of which I ask to be attached to the record.

It wasn't just the dead fish. Algae was also covering the streams and creeks to the point where people couldn't get out on the water and use their boats. Some of these people lived on these waters in multi-million dollar homes.

In 1995, another 20 to 200 million more fish died. And the algae continued to be a problem. I don't have time to cover all the bad things that were happening but it's all discussed in my prepared statement.

Eventually, a large portion of the river was shut down. Signs were posted warning people not to go near the river. Some fishermen working on the water were breathing neurotoxins present in the air. As a result, they suffered memory loss and were unable to find their way back to the dock. When they got out of the water, they couldn't find their way home. These stories were all documented in North Carolina. Very similar accounts were reported and documented on the Pocomoke River in Maryland.

We knew what was causing these problems and so did State authorities. It was nutrient pollution; too much fertilizer being discharged in the rivers. The Neuse River and many of the other waters in North Carolina were so polluted with nutrients they were declared nutrient-sensitive beginning as far back as 1993 or 1994.

After being driven from the river, I was fortunate to get a job with the Neuse River Foundation. I was hired as their Riverkeeper. For the next 7 years, I patrolled the Neuse to find and eliminate all sources of pollution. After my Riverkeeper assignment ended in

2000, I continued working as a volunteer for the Neuse River Foundation and its umbrella organization, the Waterkeeper Alliance.

Working on the Neuse River, I got the chance to find out exactly what had happened to the river and who was polluting it. Many contributed but none more than the swine industry. When I got in an airplane and viewed the watershed from the air at a thousand feet, I could count 100 lagoons. At 2,000 feet, I could often smell the hog waste. There were so many hog lagoons. They were everywhere next to wetlands, streams, creeks and rivers.

Often, especially during periods of heavy rain, the lagoons were full and the fields where they sprayed the waste were ditched. Most of these fields have pipes under them to carry the swine waste and rainwater directly to ditches and streams. The bottom line was that often this hog waste was being applied to fields not to grow crops, but to simply get rid of it by dumping.

Let me give you an idea of just how much waste is produced in eastern North Carolina. Imagine I–95 cuts down through the State and divides the State. East of I–95 is the coastal plain of North Carolina. In the coastal plain of North Carolina, an environmentally sensitive area, there are 10 million hogs producing more fecal waste each and every day than would be produced by all the people in the States of North Carolina, New York, California, Texas, Pennsylvania, New Hampshire and North Dakota.

It is stored in eastern pits called lagoons. Imagine if that were human waste. There is not a lot of difference between pig waste and human waste. Fecal waste is fecal waste regardless of where it comes from, and it is being slopped on fields under the pretext of growing crops.

In North Carolina, when it rains, everything just goes crazy. The lagoons fill with rain and swine waste. Often, the fields are so wet they shouldn't be spraying but they do it anyway.

Waste management plans are suppose to prevent this, but those plans are not worth the paper they are written on. Once the rain starts filling those lagoons, the pig waste is applied regardless of the weather.

In North Carolina, some fear these sprayfields are so poorly suited, and you are going to have a hard time believing this, many swine producers simply turn their lagoons into fountains. They spray their waste into the air for the purpose of lowering the lagoon by misting the swine waste into surrounding communities where people live.

I ask you to please play this little DVD, entitled, . . . the Rest of the Story. It is a14-minute video produced by the Environmental Justice of North Carolina. This video can be viewed on at http://www.riverlaw.us/healthissues.html In this video, you will see the suffering of the people in North Carolina. Listen to the people whose kids are breathing these harmful gases, people who live near these facilities. Most of these people were there before the swine factories moved in around them.

My time is running out. I want to move along.

Senator BOXER. You are going to need to just summarize in 10 seconds. I know that is terrible.

Mr. DOVE. OK, in 10 seconds, I will. Senator, thank you.

What is the hurry in addressing the exemption? We have had the CERCLA and EPCRA laws on the books for 30 years, and it has not impacted the CAFO industry. Why is the industry, now, all of a sudden, worried about this? Why is a preemptive strike necessary?

The Congress does not have to be in a hurry to address this. In the testimony before this committee or in the record overall, is that any evidence that CERCLA or EPCRA has ever been misused so far as the CAFO industry is concerned? Why should relief be given if there is no misuse of the law? We need this law in North Carolina to help protect the people.

Thank you.

[The prepared statement of Mr. Dove follows:]

STATEMENT OF RICK DOVE, COMMUNITY REPRESENTATIVE

Thank you, Madam Chairwoman and Members of the Committee on Environment and Public Works for the opportunity to testify today.

INTRODUCTION

My name is Rick Dove. I reside at 427 Boros Road, New Bern, NC 28560. I am a thirty-two year resident of North Carolina. I am here today speaking on behalf of myself, my family, especially my four grandchildren, and the many other citizens of North Carolina who share my view on the present and imminent dangers posed by industrial meat production in Confined Animal Feeding Operations (CAFOs). My short biographical sketch is attached as Exhibit 1.

BACKGROUND

After retiring as a Colonel from the Marine Corps in 1987, I settled down with my family in eastern North Carolina on the south shore of the Neuse River below the city of New Bern. There, I worked to fulfill a childhood dream of becoming a commercial fisherman. At first, my business flourished, and with a small fleet of boats my son and I crabbed and fished a forty square mile area of the Neuse estuary. Part of our catch was sold at a local seafood store we owned. The remainder was sold on the wholesale market.

In the mid 1980's, the Neuse was a much different river than it is today. The fish were healthy and plentiful. There were some water quality problems caused by failing waste water treatment plants and unsustainable development, but water quality was more than sufficient to safely support a high level of fishing and recreation. By the mid 1990's, this all had changed.

In September 1991, more than a billion fish died in the area where my son and I fished. These dead and dying fish were covered with open, bleeding lesions on their bodies. Some fish, both alive and dead, had holes completely through their bodies. The stench was unbearable. There were so many dead fish that at one place on the north shore, the fish had to be buried with a bulldozer.[1] Historically, small numbers of fish had always died on the Neuse during the hot summer months. But this fish kill was different. Never before had so many fish died in this manner.

At the same time as the fish were dying, my son and I both suffered the same type of lesions on our bodies that appeared on the fish. There were other symptoms. I experienced memory loss and respiratory problems. It would take years for doctors and scientists to medically link those symptoms to river pollution. Nevertheless, for my son and me, the consequence of what surrounded us was immediate. We had to stop fishing. Giving up on this long held dream was a tough decision, but there was no other choice. Not only did we have serious concerns for our health, we also worried about the safety of what we were catching and selling.

Since 1991, fish have continued to perish in large numbers in the Neuse and other coastal waters of eastern North Carolina. Depending on conditions, such as when rainfall causes runoff, these kills quickly climb into the millions. In the Neuse, nearly all these kills were located in an area near New Bern. This area is the receiving and settling place for upstream waters, much of which originates and flows from the state's farmlands and cities.

[1] http://www.abe.msstate.edu/csd/references/pfiester.htm

By the mid 1990's, the cause of these fish kills on the Neuse and other coastal rivers of North Carolina was identified by State officials as resulting from nutrient pollution, much of which, according to State officials, was coming from CAFOs. In fact, by 1993, the entire Neuse River watershed was listed by the State as nutrient sensitive, a designation it richly deserved. Normally, nutrient pollution simply deprives the water of oxygen and the fish suffocate. However, in 1995, nutrient pollution led to another, far more dangerous, consequence—Pfiesteria. Pfiesteria is a one-celled animal so tiny 100,000 could fit on the head of a pin. It produces a neurotoxin that paralyzes fish and sloughs their skin in order to devour the fish's blood cells. Simply put, it is a vampire organism. Once the news of these fish kills reached the public, the economic consequences that followed were swift and severe. After the 1995 fish kill, the tourism and fishing industries suffered substantial financial losses. So too did the real eState and development sectors of our community. Many of these consequences linger today.[2]

From April 1993 until July 2000, I served as the Neuse Riverkeeper. This was a full time, paid position funded by the Neuse River Foundation, a grassroots, non-profit environmental group. As the Neuse Riverkeeper, it was my responsibility, assisted by a corps of more than 300 citizen volunteers, to patrol the 6,100 square mile Neuse watershed by water, land and air. Importantly, it was our job to find, investigate, document and eliminate sources of river pollution. Over that period, more than 30,000 pictures and hundreds of hours of video were taken. In addition to boat and boot patrols, I personally spent more than 1,000 hours in the air locating and documenting non-point sources of pollution, most of which involved CAFOs. During this period, I also had the good fortune of working with a number of dedicated State officials and renowned scientists whose peer reviewed research into water quality and CAFO related issues were extensively published. These include but are not limited to Drs. JoAnn Burkholder and Viney Aneja of North Carolina State University; Lawrence Cahoon and Michael Mallin of the University of North Carolina, Wilmington; Stanley Riggs of East Carolina University and Steve Wing of the University of North Carolina, Chapel Hill. Since stepping down as the Neuse Riverkeeper in 2000, I have stayed current on CAFO issues by volunteering my time with environmental and community groups monitoring CAFO issues.

INDUSTRIAL ANIMAL PRODUCTION IN EASTERN NORTH CAROLINA

Nationally, North Carolina is the No. 2 producer of swine.[3] Two eastern North Carolina Counties, Duplin and Sampson, rank one and two as having the highest concentrations of swine to be found anywhere in the United States.[4] Other counties in eastern North Carolina rank in the top ten. Most of these CAFOs are located in poor communities, often of African-American descent. CAFO confinement buildings, lagoons and sprayfields are routinely situated within a few feet of the houses of local residents. In most cases, these residents were there first. It was the CAFOs that moved into their neighborhoods.[5] Overall, in the coastal plain of North Carolina, a tiny area located east of where I–95 divides the State, there are now approximately 2,500 industrial swine facilities with approximately 4,000 lagoons raising 10,000,000 hogs.[6] These lagoons are so concentrated that from an airplane flying at 1,000 feet over Duplin and other counties, more than 100 lagoons can be counted from a single spot in the air.

This is a radical change from conditions that existed prior to the mid 80's. Then, there were 24,000 family farmers raising 2.000,000 swine.[7] It was a time in North Carolina's history when family farmers raised their livestock in close proximity to their neighbors without complaint. It was also a time when the waters and air of North Carolina safely supported the needs of its citizens.

That situation changed in the late 1980's, when North Carolina State senator, Wendell Murphy, along with the Smithfield Foods' slaughterhouse operations, helped invent a new way to produce pork. Thousands of genetically enhanced hogs would be shoehorned into pens and tiny cages in giant metal warehouses, dosed with sub therapeutic antibiotics and force-fed growth enhancers in their imported feeds. Their prodigious waste would be dumped, sprayed, spilled and discharged onto adjacent landscapes, waterways and into the air.

[2]http://www.riverlaw.us/fishkills.html
[3]http://www.ncagr.com/stats/livestock/hoginv.htm
[4]http://www.ers.usda.gov/publications/agoutlook/sep2000/ao274g.pdf
[5]hhttp:// www.unc.edu/news/archives/mar99/wing2.htm
[6]http://www.riverlaw.us/consequences.html; http://www.enr.state.nc.us/files/hogs/hogplan.htm
[7]http://www.riverlaw.us/

The amount of fecal matter produced by industrial swine in eastern North Carolina is staggering. Based upon a study by Dr. Mark Sobsey, professor of environmental sciences and engineering at the University of North Carolina School of Public Health[8] that compared hog to human waste, the 10,000,000 hogs in eastern North Carolina produce more fecal waste each day than is produced by all the citizens (combined) in North Carolina, California, Pennsylvania, New York, Texas, New Hampshire, and North Dakota.

In North Carolina, this incredible amount of fecal matter is constantly being flushed from the confinement buildings where these animals are kept. Once flushed, the feces and urine from these animals is stored in the open environment in huge earthen sewage pits called lagoons. These lagoons constantly discharge to the surrounding environment by leaking into the groundwater and vaporizing their compounds through the air. As the lagoons fill up, the waste is sprayed onto fields frequently tiled with drainage pipes that promote direct runoff to nearby ditches. Most all of these ditches are connected to public trust waterways.[9] Since many CAFO sprayfields are located in areas with extremely high water tables and sandy soil, applied swine waste to fields at agronomical rates is literally "thrown to the wind." Under these conditions the swine waste is not used to fertilize crops. Instead, CAFO owners simply spray the liquefied swine feces and urine into the air in order to lower lagoon levels through vaporization. It is a process that breaks the liquefied swine waste into small particles so it can be misted into surrounding areas. CAFO owners have no control over this swine waste as it is indiscriminately deposited throughout the surrounding community. This practice is growing in popularity among CAFO owners in North Carolina. State officials are aware of the process. They have advised me that they can find nothing in the law to prevent this from happening.

The lagoon and sprayfield method of swine waste disposal is best characterized as an "outhouse" system. It causes substantial runoff to the public trust waters and pollution of the air in neighboring communities. It is especially problematic during periods of above average rainfall, which occur approximately one-half the time. It is a major polluter of both air and water through the release of ammonia, hydrogen sulfide and methane gases.

North Carolina is also heavily populated with poultry operations. Each year, in CAFOs, more than 700,000,000 chickens and 40,000,000 turkeys are produced.[10] Like swine waste, the feces and urine produced by these animals is overwhelming. It is also disposed of in a similar manner, except that there are usually no lagoons. Instead, poultry waste is composted prior to being applied to fields. As with swine CAFOs, most of the fields where poultry waste is applied contain drain tiles (pipes) and ditches to promote runoff to surface waters.

Please see Exhibit 2 for pictures that pertain to the testimony provided above.

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[8] http://www.riverlaw.us/realhogfacts.html

[9] Impacts of Waste from Concentrated Animal Feeding Operations on Water Quality Volume 115 number 2, February 2007, Environmental Health Perspective

[10] http://www.ncagr.com/stats/livestock/broilerprod.htm

EXHIBIT
2

This photo was taken in Duplin County, North Carolina in 2003. Swine waste is pictured being sprayed into the air over the lagoon for the purpose of lowering the lagoon level. This result is achieved as particles of vaporized waste are misted into the air where there are then moved by the wind into surrounding communities. This is a growing practice in North Carolina. State officials claim they are powerless to stop it.

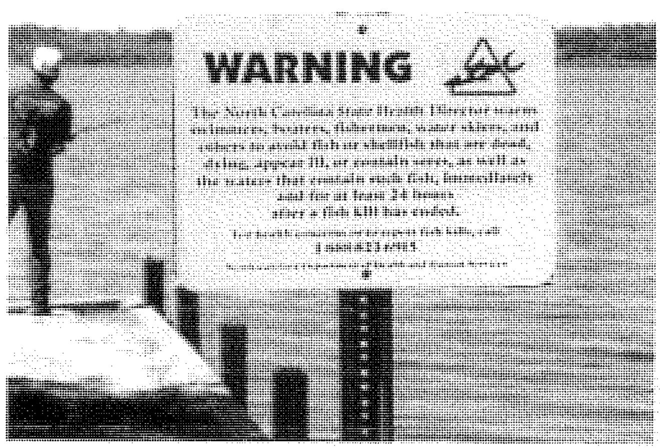

EXHIBIT 2

BROKEN PROMISES—LESSONS LEARNED

In the late 1980's and early 1990's, as the swine industry was busy setting up its CAFOs in eastern North Carolina, industry leaders told concerned citizens and political leaders that there would be no problems resulting from the use of lagoons and sprayfields. They claimed that as swine CAFOs were built, everyone would prosper; that new, good, high paying jobs would be created; and that local crop farmers would benefit as they produced crops needed for animal feed. They also calmed neighbors' fears by stating that the odors would be nonexistent or minimal and that infestation of flying insects, such as black flies would not occur. When health concerns were raised, swine CAFO promoters were quick to deny any possible link between human illnesses and hog waste, including the gasses emitted from that waste. They also boldly claimed that their operations would not adversely impact the environment because they were regulated as "Zero Discharge Waste Facilities." These were claims and promises that could not and would not be kept. This is what followed:

JOBS:

The new jobs that were promised turned out to be low paying and undesirable. Moreover, it is an absolute falsehood that converting from traditional farming practices to CAFOs creates jobs. In fact, it destroys them. The very basis of CAFO production is to produce meat by reducing cost. Everything is consolidated and concentrated. CAFOs employ the fewest possible workers. The number of hog producers in the United States was more than 1,000,000 in the 1960's. By 2005, it had dropped to 67,000.[11] While some new jobs may have been created in North Carolina as the industry consolidated its production in the state, those gains clearly came at the expense of traditional family farmers throughout the United States. New jobs are not being added due to the need for increases in hog production. According to the U.S. Department of Agriculture, the number of hogs in the U.S. inventory today is nearly the same as it was in 1915.

ODOR AND INSECTS:

Of all the statements made by CAFO owners, the one that claimed that there would be no offensive odors and no increase in flying insects, like black flies, is most reprehensible. Citizens throughout eastern North Carolina where CAFOs are located have complained about these problems since the CAFOs first arrived. Today, when questioned about the problem, the best swine industry officials offer is that "odor is in the nose of the beholder." While the problem with odor and insects is well documented in scientific reports and the complaints of citizens, nothing of real substance has been done to alleviate the problem.[12]

THE HUMAN HEALTH COSTS OF CAFOs:

Like similar operations across the country, North Carolina swine and poultry CAFOs emit significant amounts of particulate matter (fecal matter, feed materials, volatile organic compounds, skin cells, bioaerosols,etc.), ammonia, hydrogen sulfide, sulfur dioxide and other harmful contaminants into the air. Air pollution from CAFOs has been directly linked to increased respiratory diseases (such as asthma, hypersensitivity pneumonitis, industrial bronchitis) cardiovascular events (sudden death associated with particulate air pollution), and neuropsychiatric conditions (due to odor as well as delayed effects of toxic inhalations). People working in and near CAFOs have experienced increased headaches, sore throats, excessive coughing, diarrhea, burning eyes and reduced quality of life compared to more distant residents. CAFO air pollution is especially problematic, because residents close to these facilities are exposed on a near constant basis.[13]

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[11]Community Health and Socioeconomic Issues Surrounding Concentrated Animal Feeding Operations Environmental Health Perspective, Volume 115 number 2, February 2007

[12] http://www.rollingstone.com/politics/story/12840743/porks—dirty—secret—the—nations—top—hog—producer—is—also—one—of—americas—worst—polluters/4

[13]For information on these pollutants and the human health impacts identified in this paragraph see the following: Iowa State University and The University of Iowa Study Group, Iowa Concentrated Animal Feeding Operations, Air Quality Study, Final Report (2002) ("Iowa Air Quality Study"), http://www.publichealth.uiowa.edu/ehsrc/CAFOstudy.htm; Minnesota Planning Agency Environmental Quality Board, Final Animal Agriculture Generic Environmental Impact Statement (2002), ("Minnesota EIS for Animal Agriculture"), http://www.eqb.state.mn.us/geis/ for information concerning health impacts of particular AFO air pollutants; North Carolina Residents, 108 Envtl. Health Persp. 223–38 (2000); S. Wing & S. Wolf, Intensive Livestock Operations, Health, and Quality of Life Among Eastern K. Thu et al., A Control Study of the Physical and Mental Health of Residents Living Near a Large-Scale Swine Operation, 3 J. Agric. Safety & Health 1, 13–26 (1997)

Ever since the hog industry established CAFOs in North Carolina, citizens have been complaining and expressing their health concerns as hog waste was being sprayed on their persons and property, odors and black flies invaded their houses and their wells became contaminated. They also complained about the lack of redress on these matters from State officials and CAFO owners. Recently, a number of these citizens from across eastern North Carolina recorded their concerns and feelings in a locally produced documentary entitled:. . . .the Rest of the Story: Corporate Hog Farming in North Carolina. This 14 minute documentary more appropriately presents the environmental injustice these citizens suffer far better than I could possibly do through my testimony. A copy is attached as Exhibit 3. Your review of this material is highly encouraged.

THE SAD TRUTH:

In North Carolina, like the rest of the country, none of the air pollution emitted by CAFOs is regulated or controlled by State or Federal agencies. None of these operations has Clean Air Permits or anything equivalent under North Carolina law. As a result, there are few, if any, regulatory requirements to address air and odor pollution from swine and poultry factories and citizens have little legal recourse when they experience these afflictions. As Pickle Robins, a local farmer living next to a swine CAFO once told me, "They can just put the stink on you and there isn't anything you can do about it and that's the sad truth."

DRINKING WATER CONTAMINATION:

Throughout eastern North Carolina, residents depend heavily on private wells to supply drinking water for their families. Due to widespread concerns voiced by these citizens that their wells might be contaminated with nitrates from animal waste, in his second term, Governor James B. Hunt, Jr., made free well water testing for nitrates available to all North Carolina citizens living adjacent to industrial swine facilities. During the next 2 years, a total of 1,595 wells in 57 counties which were adjacent to swine facilities had been tested for nitrates. The results were alarming. Of the tested wells, 163 (10.2 percent) showed nitrate contamination at or above the drinking water standard of 10 mg/L. In some counties, the percentage of contaminated wells was near 50 percent.[14] Contaminated wells continue to be discovered and the North Carolina General Assembly has been pressed by local citizens to address the problem

CAFOs POLLUTE OUR WATERWAYS:

Nutrient pollution from swine CAFOs has been scientifically linked to the fish kills previously mentioned in this testimony and the growth of algae and other aquatic vegetation that clogged North Carolina waterways. Along the Trent River, a major tributary of the Neuse, more than 71 miles of waterway was identified as impaired by State officials as a direct result of nutrient pollution from CAFOs.[15] As a result of these fish kills and the dangers presented by Pfiesteria outbreaks, State officials posted the Neuse River estuary with signs warning citizens not to go in or near the water when fish are distressed and/or dying.

What impact has pollution from swine and other CAFOs had on the Neuse River? In 1995, 1996 and 1997, due to nutrient pollution from CAFOs and other sources, the Neuse was listed as one of the most threatened rivers in North America. That listing, coupled with media attention and lawsuits brought by the Neuse River Foundation, forced State officials to take affirmative action aimed at reducing nutrient loading to the Neuse. Unfortunately, these efforts have only been partially effective. What success has been achieved in nutrient reduction has been credited more to drought conditions and the corresponding lack of runoff than anything the State has done, especially as it relates to pollution from CAFOs.

In 2006, a number of internationally renowned North Carolina scientists (Dickey, Burkholder, Reed, Mallin, Cahoon et al) released the results of a 10-year data collection and analysis project undertaken for the purpose of determining water quality trends in the Neuse River estuary. The study period was from May 1993 to June 2003. All sampling and analytical procedures were recognized by both State and Federal regulatory agencies, and any modifications were sanctioned by the Environmental Protection Agency. The study found that the loading of nutrients, especially nitrogen, should have been substantially reduced over the period due to a reduction goal legislated by the North Carolina General Assembly. This goal of attaining a 30 percent reduction in nitrogen arriving at the Neuse estuary required major adjustments by nearly all major contributors. Based upon the actions taken, a substantial reduction should have resulted. Many crop farms have ceased production and those remaining have cut their use of fertilizer by as much as 40 percent. Industrial and

[14] http://www.epi.state.nc.us/epi/mera/ilocontamination.html

[15] http://H_2O.enr.state.nc.us/list—303d/listnar.pdf

municipal wastewater treatment plants substantially upgraded their facilities to reduce nutrient discharges. At the Neuse estuary and upstream to Goldsboro, 11 wastewater dischargers committed to the removal of their river discharges (most now removed). Additionally, mandatory buffer protections were enacted along with rules substantially restricting the discharge of sediments and stormwater. Unfortunately, there was no reduction. To everyone's dismay, the report noted an alarming increase in ammonia levels found in the Neuse estuary. It also revealed that concentrations of ammonium, the most destructive form of nitrogen, dramatically increased by 500 percent. Ammonia not only stimulates prolific alga blooms, it is also the agent that promotes fish kills. Where is all that ammonia coming from? According to State authorities, "Approximately 2/3 of the nitrogen in the swine excretions is emitted to the air in accordance with the design of a lagoon and sprayfield system. A DENR study estimates that swine facilities produce 20 percent of North Carolina's total atmospheric nitrogen compounds which react with other constituents in the air and is deposited to land, vegetation, and water bodies. This figure is 53 percent for just Eastern North Carolina"[16]

The Neuse is not alone in the degradation suffered from CAFO pollution. In a related set of trend analyses, a significant increasing trend in ammonium concentrations was also found for an adjacent, more rapidly flushed system, the Cape Fear Estuary.[17]

Millions of fish died in other rivers as well. Many had open, bleeding lesions on their bodies similar to those in the Neuse. In 1995, the New River near Jacksonville, North Carolina was severely impacted when a CAFO lagoon broke through its earthen wall. More than 20,000,000 gallons of swine waste spilled into the river killing millions of fish.[18] Large fish kills related to nutrient pollution have also been reported in the Tar-Pamlico River and the Pamlico Sound and in other waters across North Carolina.[19]

It is not surprising that in 2007, in large measure due to CAFO pollution, the Neuse was placed back on the list of the 10 Most Endangered Rivers in America.[20]

WIND, RAIN AND FLOODS:

When hurricanes, tropical storms and heavy rains routinely threaten to flood North Carolina, pollution discharges from CAFOs substantially increase. In aerial flights over swine CAFOs immediately preceding heavy rain events, large numbers of CAFOs are observed dumping animal waste just hours before the storm's scheduled arrival. The number of CAFOs spraying waste under these conditions far exceeds what would be observed on a normal day. Clearly, these operators understand that what they are applying on their fields will, for the most part, be washed into the wetlands, streams and rivers once the heavy rains arrive. For these operators, it doesn't matter. Their only objective is to do everything they can to lower their lagoon levels in advance of the storm.[21] North Carolina is often referred to as "hurricane alley." It is a well deserved label. Unfortunately, the swine lagoons in eastern North Carolina lay directly in the path of these storms. The results are often catastrophic. In 1999, when hurricane Floyd made its way across North Carolina's coastal plain, more than 50 lagoons were flooded. So much hog waste was spilled that its pinkish color could be clearly observed running down the river. Thousands of hogs, both alive and dead, were also observed in the river, on the tops of flooded confinement buildings and in piles waiting to be buried. Estimates of dead hogs ranged widely between 30,000 and 400,000. The correct number may never be verified. After the storm, Governor Hunt promised that all of the flooded lagoons as well as those in the flood plain, would be shut down. Later, he changed his mind and proclaimed that only those CAFOs that were damaged by more than 50 percent would be eliminated. In the end, only a handful were shut down. Most still remain in harms way waiting for the next storm and new promises of corrective action.[22]

Some years the State experiences excessive rainfall. This last occurred in 2003 when rainfall exceeded 100 year record levels. The rains began in January and con-

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[16]http://www.enr.state.nc.us/files/hogs/hogplan.htm (originally publish at this site—no longer available) Excerpts available at www.riverlaw.us

[17]Burkholder, J.M., D.A. Dickey, C. Kinder, R.E. Reed, M.A. Mallin, G. Melia, M.R. McIver, L.B. Cahoon, C. Brownie, N. Deamer, J. Springer, H. Glasgow, D. Toms and J. Smith (2006) Comprehensive trend analysis of nutrients and related variables in a large eutrophic estuary: A decadal study of anthropogenic and climatic influences. Limnology and Oceanography, volume 51, pp. 463–487.

[18]http://scholar.lib.vt.edu/VA-news/VA-Pilot/issues/1995/vp950626/06260030.htm

[19]http://www.esb.enr.state.nc.us/Fishkill/fishkill.htm

[20]http://www.americanrivers.org/site/PageServer?pagename=AR7—MER2007—Neuse

[21]http://www.riverlaw.us/hurricanefloyd/hurricaneisabel.html

[22]http://www.riverlaw.us/hurricanefloyd.html http://www.mhhe.com/biosci/pae/es—map/articles/article—53.mhtml

tinued through October. The fields were so saturated that farm tractors were unable to plow many of the fields. On many farm fields, what crop was able to be planted, drowned under the onslaught of water. Meanwhile, the rains continued to fill the lagoons. This situation was exacerbated by the inability of swine CAFO operators to apply swine waste to fields at agronomical rates as required by law and their waste management plans. As the hogs kept eating and defecating, the lagoons filled even faster. One solution would have been to reduce the size of the swine herd. That didn't happen. The swine inventory at the beginning of the year was reported at 9,000,000. At year's end, it was recorded at 10,000,000. Under these conditions, it was impossible for most CAFOs to follow the law and apply their swine waste at agronomical rates. So where did all that waste go? No doubt—it went down the river. This is clearly documented in the pictures and video that were taken during the year.[23]

As a result of the developing problems in CAFO operations, since 1997, the North Carolina General Assembly has imposed a moratorium on the construction of new hog lagoons and sprayfields (except for those obtaining permits before the effective date of the moratorium).

ANTIBIOTICS AND CAFOs:

Industrial meat producers routinely dose their animals with sub-therapeutic antibiotics for non-medical purposes, primarily to stimulate unnaturally rapid growth in hogs. The excessive use of antibiotics is an integral part of the production system both to bring them to market faster and to keep them alive in otherwise unlivable conditions. Many of the antibiotics given to livestock, such as tetracycline, penicillin, and erythromycin, are important human medicines. Up to 80 percent of antibiotics administered to hogs pass unchanged through the animal to bacteria rich waste lagoons. This soup is then spread on sprayfields, allowing the antibiotics to enter groundwater and run off into surface waters.

Routine administration of sub-therapeutic antibiotics endangers public health by contributing to drug-resistant pathogens with which humans and animals may come in contact through groundwater, surface water, soil, air, or food products. Once antibiotics have entered hog factory effluents, they can enter waterways and spread through the environment in low concentrations—killing susceptible bacteria and leaving resistant survivors to multiply. Resistant bacteria can then infect people who swim in lakes and rivers or drink well water. The Environmental Protection Agency has found antibiotics administered to swine, in lagoons, groundwater, air above sprayfields, adjacent waterways and the main stream of the Neuse River.

In January 2001, the Union of Concerned Scientists issued a report that included the following shocking statistic: 84 percent of all antibiotics consumed are used in livestock, the vast majority for non therapeutic purposes! The hog industry uses 11 million pounds of antibiotics annually while a comparatively modest three million pounds are used in human medicine.[1]

Antibiotics administered to hogs are now making their way into the air, groundwater and our rivers and streams .At one North Carolina CAFO, swine antibiotics have been found in the tap water. The EPA has also reported finding antibiotics used in swine production in the main stream of the Neuse River.[2]

THE GOVERNORS SPEAK OUT

Having credibility on CAFO issues is critically important. The industry works hard and spends a great deal of money on lawyers and lobbyists who attack critics in an effort to confuse the issues. While there are countless peer reviewed scientific studies that clearly support my testimony, some of the strongest support for what I have stated comes from two of North Carolina's leading State officials who served as Governor during the establishment of CAFOs and the aftermath that followed. These were: Governors Hunt (1993—2001) and Easley (2001—). Their positions on swine CAFOs are set forth below:

Governor James B. Hunt, Jr. (1993—2001)

In the late 1990's, then North Carolina Governor James B. Hunt, Jr's administration strongly condemned the pollution practices of swine CAFOs.

[23] http://www.riverlaw.us/enforcement.html

[1] NRDC, Cesspools of Shame, How Factory Farm Lagoons and Sprayfields Threaten Environmental and Public Health, 2001.

[2] http://www.factoryfarm.org/docs/CivEngSeminarPresentation.pdf

Here are some excerpts from his State sponsored website:[3]

"Background"

Swine production has mushroomed over the last decade. Despite a decreasing number of swine facilities, the number of hogs has increased threefold to ten million. . . .There are approximately 2,400 major swine facilities in North Carolina with approximately 4,000 active anaerobic lagoons, and there are about 650 inactive swine lagoons. . . ..

Economic Impacts

. . . .swine production in North Carolina can produce significant odor, reduce neighboring property value, and harm tourism.

Environmental and Public Health Impacts

. . . .the environmental and public impacts of the swine industry demand further action by the State and the swine industry. Swine production impacts to the environment and public health are listed below.

- Surface Water. Surface water can be contaminated by discharges from the lagoons or run-off from sprayfields. In 1998, there were 107 documented discharges from swine facilities with 31 of these reaching the surface waters.
- Groundwater. Groundwater can be contaminated either through leaking lagoons or leaching of sprayfield applied waste. An NCSU study showed that waste from 38 percent of older, unlined anaerobic lagoons leaked nitrogen compounds into the groundwater at "strong" or "very strong" levels, while preliminary estimates of a Department of Environment and Natural Resources (DENR) study indicate that 25 percent of lined facilities may leak to contaminate groundwater. DENR data show that conventional sprayfields seem to be just as problematic as lagoons.
- Odor. Odors are generated from lagoons, sprayfields, or swine houses. When odors are not confined to the property of the operations, they have the potential to cause health problems, heightened community tensions, and losses in property values. . . .
- Atmospheric Deposition. Approximately 2/3 of the nitrogen in the swine excretions is emitted to the air in accordance with the design of a lagoon and sprayfield system. A DENR study estimates that swine facilities produce 20 percent of North Carolina's total atmospheric nitrogen compounds which react with other constituents in the air and is deposited to land, vegetation, and water bodies. This figure is 53 percent for just Eastern North Carolina.
- Nutrient Imbalance. The rapid growth of the swine industry has resulted in a nutrient imbalance in parts of North Carolina. The feed imported to swine facilities generates more nutrients than receiving plants, land, and waters can absorb. For example, 95 percent of the nitrogen in manure produced in the Neuse River Basin is imported from outside the basin.
- Public Health. Swine waste is a source of nitrates in groundwater and pathogens in the ground and surface waters which can directly impact human health. Odors too can adversely impact human health as they can cause coughing, nausea, dizziness, headaches, and burning eyes as well as psychological effects. . . ."

Governor Michael F. Easley

In 2000, while campaigning for Governor, Michael Easley, the current Governor of North Carolina, published a White Paper containing the following commitments to rid the State of swine CAFO lagoons and their pollution.[4]

"My comprehensive clean water plan starts with the obvious point that the anaerobic swine waste lagoon and spray field system has proved to be too risky. It must go. As Governor, I will lead a broad, consistent effort to address the environmental degradation caused by large-scale, factory hog farming. Certainly, the companies that own and profit from the hog industry must bear their fair share of legal liability when the people they hire break our water quality laws. Those who enjoy direct financial benefits from hog production must have an economic incentive to promote compliance with State environmental rules. Therefore, my Administration will make sure that major hog companies, and other "integrators" of small farmers into large-scale hog operations, share liability for water quality violations at their contract farms.

Moreover, a lagoon phase-out, starting with those abandoned and in flood plains or other at-risk locations, is also critical. Hog lagoons have spilled into our water-

[3] http://www.enr.state.nc.us/files/hogs/hogplan.htm (originally publish at this site—no longer available) Excerpts available at www.riverlaw.us

[4] http://www.riverlaw.us/thegovernors.html

ways too often, and the issue of damage from atmospheric nitrogen and ammonia falling as rain is too serious to continue with "business-as-usual."

As a result, the phaseout of hog waste lagoons must begin immediately, and be subject to a strict timetable. Demanding compliance with this timetable will force the development of new, environmentally friendly technologies to control hog waste. As such technologies develop, the timetable can be accelerated. But mandatory deadlines are necessary to continue the pace of research and development, and to force implementation. Specifically, as Governor, I will insist on the following timetable:

(1) Large scale, on-farm installation of testing and new technologies, at the expense of integrators, to begin immediately;

(2) Testing, evaluation, and oversight of new waste facilities, by independent scientists, beginning in year one;

(3) Full scale installation of the technologies found most effective, no later than years three and four; and

(4) Completion of phaseout and total elimination of the lagoon system no later than year five, and substantially sooner if the independent scientists determine that faster implementation is possible.

Whether by the initiative of the elected branches or by court order, the outmoded lagoon system will be replaced. The real question is what will take its place. Converting to cleaner, safer waste technologies will come at a price. We must be sensitive to independent family farms, so many of which have attempted to operate responsibly. These farmers simply played by the rules set by the General Assembly. Still, they must convert and, as Governor, I will see that they do so. While the conversion is underway, large-scale farms must make operational improvements, including buffers, biocovers, and windbreak walls, to minimize dangers to our waters, as well as our air"

NORTH CAROLINA 2007—HOPE TURNS TO DESPAIR

In 2007, the North Carolina General Assembly was poised to pass legislation mandating a plan to rid the State of the lagoons and sprayfields used by CAFOs . Several pending bills would have accomplished the following:[5]

- Set a date certain after which the use of lagoons and sprayfields would no longer be authorized for use by swine CAFOs.
- Ban the construction of new lagoons
- Establish new standards required for the treatment of swine waste
- Provide some State funding to help small swine producers make the transition from lagoons to the newly approved technologies.
- Provide some limited funding to help private citizens with contaminated wells obtain other sources of drinking water.

By the time the legislative session ended in August 2007, little remained of what was originally proposed. The date certain legislation was turned into a study bill and the legislation to prohibit new lagoons was totally compromised. A bill was passed that did ban the construction of lagoons on newly constructed facilities. However, through intense lobbying of the swine CAFO industry, a compromise brokered by Governor Easley provided for the repair of existing lagoons and replacement of those lagoons with new lagoons when they could no longer be repaired and imminently threatened public health. Swine lagoons have a useful life of approximately 20—25 years and at some point they will all have to be replaced. In this regard, there is little doubt of where the industry is headed. Lagoons and sprayfields represent the cheapest method for disposing of hog waste. Regardless of their harm, operating lagoons is profitable and that is the industry's bottom line.

Making matters worse was another amendment that encouraged the continued use of existing lagoons and sprayfields by swine CAFOs through the capture of methane gas. What this legislation authorized was the partial covering of existing lagoons with a tarp to capture methane gas. The intended outcome is for CAFO owners to be able to sell that methane to utility companies for up to four times its true market value. Utility companies participating in the methane capture program would be permitted to pass these additional costs to their ratepayers. The capture of methane gas is a laudable objective, but it must incorporate the newly approved technologies that move the industry away from lagoons and sprayfields that massively pollute.

[5] http://www.ncga.state.nc.us/gascripts/BillLookUp/BillLookUp.pl?Session=2007&BillID=s1465

WHY CAFO POLLUTION MUST BE BROUGHT UNDER CONTROL

By illegally polluting, industrial hog producers gained a critical advantage over their competitors—the traditional family farmer—in the marketplace. These are not businessmen making an "honest buck." Instead, they are lawbreakers who make money by polluting our air and water and violating the laws with which other Americans must comply.

Environmental lawbreaking is an integral component of factory pork production. Records of State environmental agencies in over a dozen states demonstrate that factory hog producers are chronic violators of State and Federal law. For example, North Carolina's Department of Environment and Natural Resources ("NCDENR") records show thousands of violations of State environmental laws by Smithfield's facilities During periods of above average rainfall, violations are significantly increased. NCDENR officials readily admit that at critical times they do not have the resources to enforce the law. As a result, enforcement is virtually non-existent except for what private citizens are able to do pursuant to the provisions of the Federal Clean Water Act. The number of violations is believed to be considerably greater since, prior to 1995, the environmental agency was not even allowed to know the locations of the hog factories, or to inspect them unless 'invited' to do so by the operators or owners. Even today, State water quality inspectors and State and local county health officials are not permitted to go inside swine CAFO confinement buildings. That is the sole responsibility of the State Veterinarian who works under the North Carolina Department of Agriculture—a CAFO friendly agency. The massive and persistent drumbeat of violations recorded in these documents prove that hog factories and their facilities are chronic, deliberate and habitual violators of State laws designed to protect the environment and minimize discharges of swine waste.

Indeed, without breaking the law, pork factories cannot make money and produce hogs as efficiently or cheaply as family farmers. Industrial pork producers instead rely on rare inspections and small fines by State regulators. The rare penalties and small dollar amounts occasionally dispensed by State enforcers never provide sufficient incentive for the industrial pork barons to stop their lawbreaking. These fines amount only to a trivial cost of doing business.[6]

ALTERNATIVES

There are myriad alternatives to the CAFO lagoon and sprayfield system, but the industrial hog producers refuse to adopt innovations that might cut profit margins. In 2000, Smithfield Foods, the world's largest pork producer, entered into an agreement with the Attorney General of North Carolina that funded the evaluation of environmentally superior waste management technologies for use on North Carolina swine farms owned by them. Later, Premium Standard Farms and Front Line Farmers, joined in the agreement. Smithfield and Premium Standard provided all the funding for this effort.. Dr. Mike Williams, Director of the Animal and Poultry Waste Management Center at North Carolina State University was designated to oversee the project. As a result of this effort, a number of technologies were developed that would, when fully implemented, eliminate the use of CAFO lagoons and sprayfields. One approved system was, Super Soils. Unfortunately, the Smithfield Agreement provided that any new technology had to be economically feasible. This provision, by measuring the cheap cost of constructing and operating a lagoon system against any new technology, made it impossible to meet economical objections from swine CAFO owners. However, one study concluded that while costs were higher for Super Soils systems, there were benefits that dramatically outweigh these costs.

The result of one study reported by the Charlotte Observer on July 15, 2007, stated:

"our State could gain the economic equivalent of 7,000 jobs and enjoy a $10 billion economic boost if the industry adopted technology that produced usable by-products from hog wastes. The Super Soils technology identified by researchers at N.C. State University would provide one effective alternative. Farmers could produce container mix for use in nurseries and other plant growers and boost employment. Over a 20-year period that could generate thousands of jobs and produce up to $1.1 billion in farm revenue. It also would reduce air pollution and dangers to health and avoid accidental lagoon breaches that can pollute waterways"

[6]www.riverlaw.us; http://www.senate.gov/?gov—affairs/031302dove.htm

So why would CAFO industry leaders refuse to give these new technologies a chance in North Carolina where they are so desperately needed? The answer to that question probably has less to do with North Carolina than it does with the swine industry's operations across the rest of America's farmlands. When new innovative technologies are successfully adopted and proven to work in this state, their use will be demanded wherever lagoons and sprayfields are in use. The record of this industry clearly reflects that regardless of the public need and benefit, industrial bottom line financial considerations will always prevail.

Does the industry have the financial ability to make the switch to cleaner technologies? They do! Smithfield Foods, the world's largest swine producer and owner of most all hogs in North Carolina, has doubled its net earnings over the past 5 years to 11.5 billion dollars. Their CEO and other top executives are rewarded annually with millions in bonuses.[7]

Another alternative to swine and other CAFO production is traditional family farming where hogs and other livestock are raised without lagoons and confinement buildings. No one has ever stood in line to buy pork in America. Traditional family farmers have always been able to keep the shelves full. Industrial farming practices do have a serious downside. Too often, corporate profits take precedence over all other considerations, including animal welfare, environmental protection, social responsibility and the safety of residents living of neighboring communities. CAFOs represent a race to the bottom. It is not sustainable and it will fail. Clearly, these facilities operate outside the laws of nature. To believe that raw animal waste can be safely contained in 4,000 thousand earthen pits left baking under the hot summer sun in a concentrated and environmentally sensitive area of the state—is nothing short of insane. There will be consequences. The question is—how bad and when?

CONCLUSION:

North Carolina's experience shows that the environmental laws which limit pollution from factory farms need to be strengthened, not weakened. Any effort to amend CERCLA and EPCRKA to exempt CAFOs would be a significant reversal, eliminating much needed protection for our communities and the environment while rewarding known polluters with an ill-deserved amnesty. CAFO owners, especially the large integrators, contend that they are not a part of the problem. After all, it's just manure. And if, as they claim, there is no problem, why are they seeking relief from laws that support public safety and protect our air and water?

Farm industry lobbyists and supporters claim that CAFOs are already extensively regulated under the Clean Water Act, the Clean Air Act, and that CERCLA and EPCRKA add unnecessary regulatory burdens. In fact, no swine or poultry operations in North Carolina are regulated under the Clean Air Act, and only swine operations are covered by Clean Water Act NPDES permits. In the wake of the 2002 Waterkeeper Alliance v. EPA court decision, the North Carolina poultry operation successfully lobbied State agencies to exempt most poultry CAFOs from the requirement to obtain an NPDES permit. As a result, in North Carolina an entire industry, one now seeking an exemption from CERCLA, is unregulated by any environmental law.

North Carolina's NPDES permits, like nearly every other CAFO permit in the Nation, rely on the calculation of agronomic rates that let swine producers apply as much waste to fields as crops can take up. Unfortunately, this method has failed to prevent discharges of excess nutrients to our streams and rivers, and of course, there is no agronomic rate for pollutants such as fecal coliform and other pathogens. In short, current research indicates that the Clean Water Act regulatory program is insufficient to protect our surface waters and groundwater drinking supplies.

It is important to recognize that the solution to many of the pollution problems caused by factory-style livestock operations may be solved by sustainable family farmers. These farmers, historically the bedrock of American agriculture, are not subject to the requirements of CERCLA and EPCRKA and would not benefit from the proposed exemption. Indeed, Congress had this community in mind in 1986 when it originally drafted CERCLA to have an exemption for the "normal field application of fertilizer." The proposed changes to CERCLA and ECPRKA amount to a legislative bail-out that would only aid large factory farm operators who are unable to manage responsibly the large quantities of manure they produce. Some operations have polluted groundwater and surface water with excess nutrients and dangerous pathogens, arsenic and other toxic metal compounds and antibiotics.

[7]http://www.changetowin.org/why-organize/corporate-hall-of-shame/smithfield-foods.html

The scale of this pollution can be truly shocking. There is evidence that some large animal confinements can release enormous quantities of toxic chemicals—comparable to pollution from the nation's largest manufacturing plants. For example:

• Threemile Canyon Farms in Boardman, Oregon, reported that its 52,300 dairy cow operation emits 15,500 pounds of ammonia per day, more than 5,675,000 pounds per year.[1] That's 75,000 pounds more than the nation's No. one manufacturing source of ammonia air pollution (CF Industries of Donaldson, Louisiana) reported according to the 2003 Toxics Release Inventory.

• Buckeye Egg's facility in Croton, Ohio, had ammonia emissions of 1,600,000 pounds in 2003.[2] This amount corresponds to roughly 4,400 pounds per day, or about 44 times the reporting threshold that EPA set based on health considerations.

CERCLA currently provides a much needed avenue of response for community officials. In an often-cited example, the city of Waco, Texas is spending more than $54 million for capital improvements specifically to deal with taste and odor problems caused by excessive phosphorus pollution from dairy cow waste. Facing what appeared to be ever-increasing water treatment expenditures to eliminate ever-increasing nutrient loadings from agricultural operations, the City urged upstream feeding operations to adopt better manure management techniques. When that effort failed, they used the most effective legal tool available: a CERCLA cost recovery suit. The suit—against 14 operations that had a history of problems—was used not to shut down dairies or collect moneys from farmers, but to leverage new, enforceable agreements for better manure management at these facilities.

If Congress amends Superfund with a special exemption for livestock waste, it will deny the city of Waco and others American communities a critical legal tool for protecting their invaluable water supplies from pollution by large-scale agricultural operations that fail to properly manage their waste. Such an amendment would declare that water users, not polluters, must bear the burdens of pollution, a radical shift from the "polluter pays" principle enshrined in CERCLA and in our common sense of right and wrong.

Another impact of the proposed exemptions would be to prevent Federal, State and local emergency responders from accessing information about toxic releases from these facilities. As discussed above, many of the large feeding operations release large volumes of hazardous air pollutants, such as ammonia and hydrogen sulfide and an increasing number of studies have found a variety of health problems among animal feeding operation workers and residents who live near these operations, including bronchitis, asthma, and antibiotic-resistant bacterial infections. These findings are of great concern to many rural communities, and action by Congress to ban reporting by these facilities would do a great disservice to those who are working hard to develop a better understanding of the full impacts of these releases.

Representatives of some large-scale agriculture operations have argued to Members of Congress and to farming communities that such an amendment is urgently needed to protect family farms from frivolous lawsuits and allow farmers to continue to use manure as fertilizer for crop production. These assertions are simply untrue, and grossly misrepresent both remedies available under the statute and current legal trends. There are three key points correcting this misinformation. First, as indicated above, CERCLA's cost recovery and reporting requirements do not threaten responsible operators who manage manure as a valuable fertilizer. Second, neither CERCLA nor EPCRKA contain "citizen suit" provisions similar to those in the Clean Water Act or Clean Air Act. In fact, only municipal, State and tribal governments can bring the type of cost-recovery actions brought by the city of Waco and State of Oklahoma. Third, there is no rash of frivolous lawsuits currently clogging the courtrooms of America and forcing farmers into bankruptcy. In fact, in the 25-year history of CERCLA, there have been only 3 cost-recovery lawsuits against animal feeding operations to address manure-related contamination.

• City of Tulsa v Tyson Foods targeted several large chicken operations and attempted to recover costs for water treatment incurred by the City and the Tulsa water utility. The case was settled in 2003.

• In 2004, the city of Waco sued 14 dairy operations for water quality problems with Lake Waco, the City's drinking water supply. Settlements were reached with all 14 defendants.

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[1]Letter from Tom Lindley on behalf of Threemile Canyon Farms to EPA Region X, April 18, 2005

[2]United States v. Buckeye Egg Farm, L.P. et al, Civil Action No.3:03 VC7681,

• In 2005, the State of Oklahoma sued large-scale poultry producers for redress of water quality problems in the Illinois River watershed. This case is still pending.[3]

These lawsuits involved large-scale animal operations or operations that had a history of problems with manure management. In each case, the lawsuit followed long controversy and attempted negotiations regarding waste management practices. Lawsuits were filed after previous negotiations failed and water quality conditions worsened. Settlements involved plans for improved manure management, not penalties.

As indicated by the scope of the pollution problem caused by factory farms, we need strong, broad, and effective environmental laws to protect natural and human resources from the ill effects of industrial-scale livestock pollution.

While CERCLA's cost recovery provisions are important for governmental responses to hazardous conditions, for advocates like myself, the real value of the law, and of EPCRKA's parallel provisions, lies in the right-to-know reporting provisions of CERCLA Section 103 and EPCRKA Section 304. Information about chemical releases enables citizens to hold companies and local governments accountable in terms of how toxic chemicals are managed. Transparency also often spurs companies to focus on their chemical management practices since they are being measured and made public. In addition, the data serves as a rough indicator of environmental progress over time. The amendment proposed by the livestock industry's allies would deprive Americans of this much needed resource, and prevent them from playing meaningful roles in the democratic process.

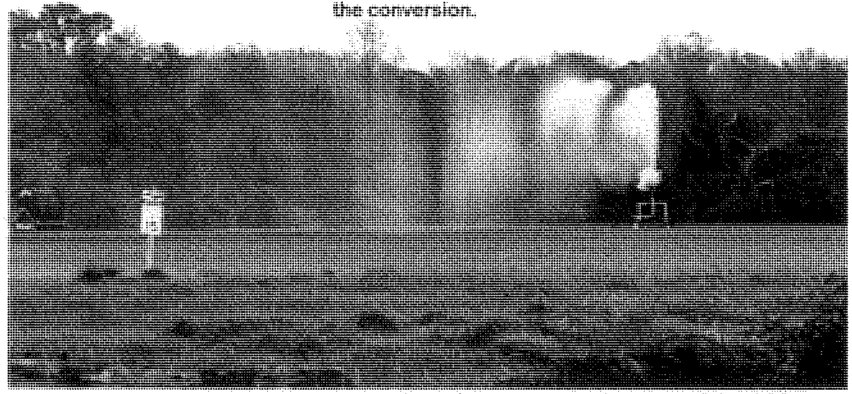
The answer to the current situation, one in which rural residents are forced to endure sickness and nuisances, is more reporting of air emissions as required by CERCLA and EPCRKA, not a reprieve for those responsible for creating such misery. CERCLA and EPCRKA create an obligation for large livestock producers to share information with their neighbors, information that is vital for identifying, treating, and preventing illnesses; information that allows community leaders and health officials to develop protective placement and response plans; information that reveals the truth about this industry and inspires reforms in its practices. In North Carolina and across the Nation, we need more of this information, not less.

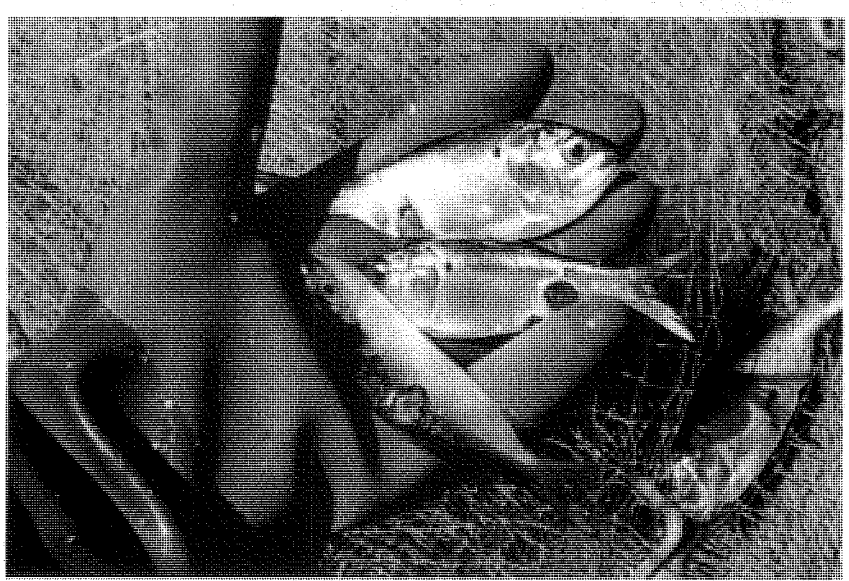
Very respectfully submitted

Rick Dove

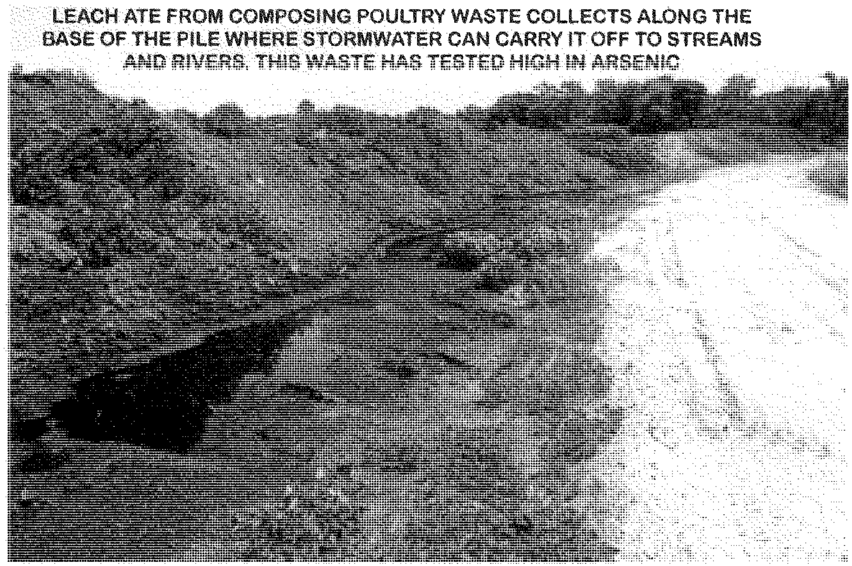
[3] Civil Action No. 4:05-cv–000329 JOESAJ, United States District Court for the Northern District of Oklahoma.

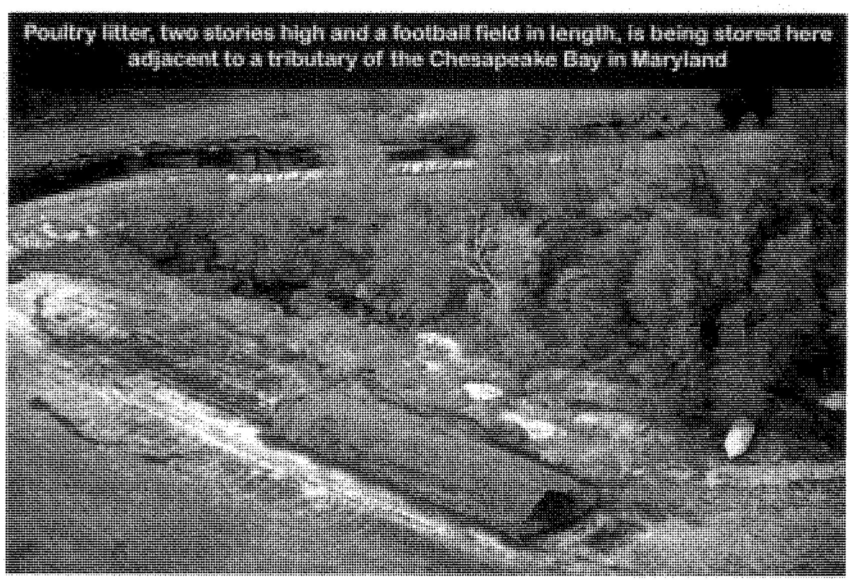
Hog waste is easily misted into the air as it is sprayed on fields. The same happens as it is sprayed over lagoons. The wind easily carries the waste into surrounding communities where people live and children play. Afforable alternative technologies are available to prevent this from happening. The industry has the financial resources to make the conversion.

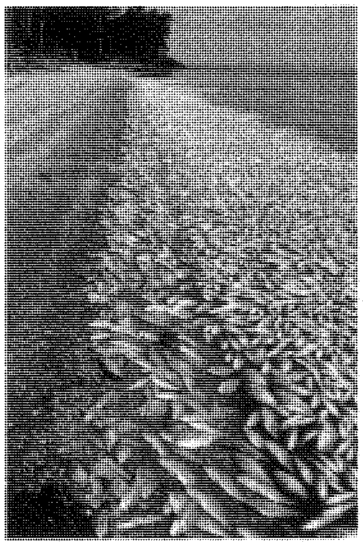




More than a billion fish have died in the Neuse River estuary since the swine CAFOs set up operations in eastern North Carolina


LEACH ATE FROM COMPOSING POULTRY WASTE COLLECTS ALONG THE
BASE OF THE PILE WHERE STORMWATER CAN CARRY IT OFF TO STREAMS
AND RIVERS. THIS WASTE HAS TESTED HIGH IN ARSENIC

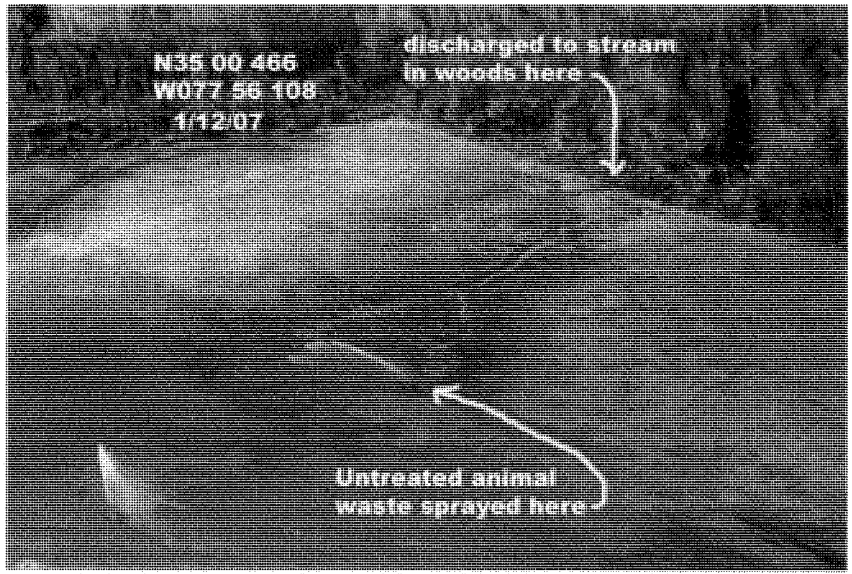

Poultry litter, two stories high and a football field in length, is being stored here
adjacent to a tributary of the Chesapeake Bay in Maryland



Dead fish litter shore of the Neuse River,

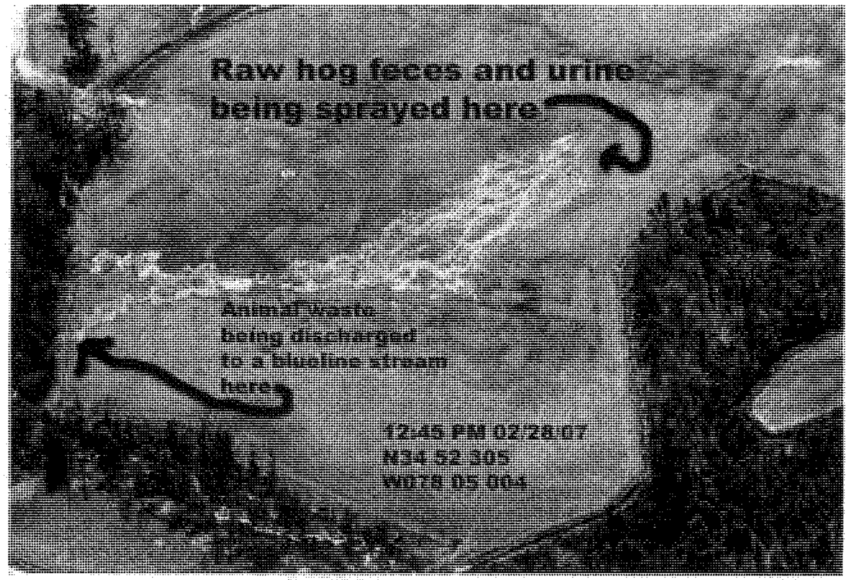
Sign on Neuse River warns peope of danger

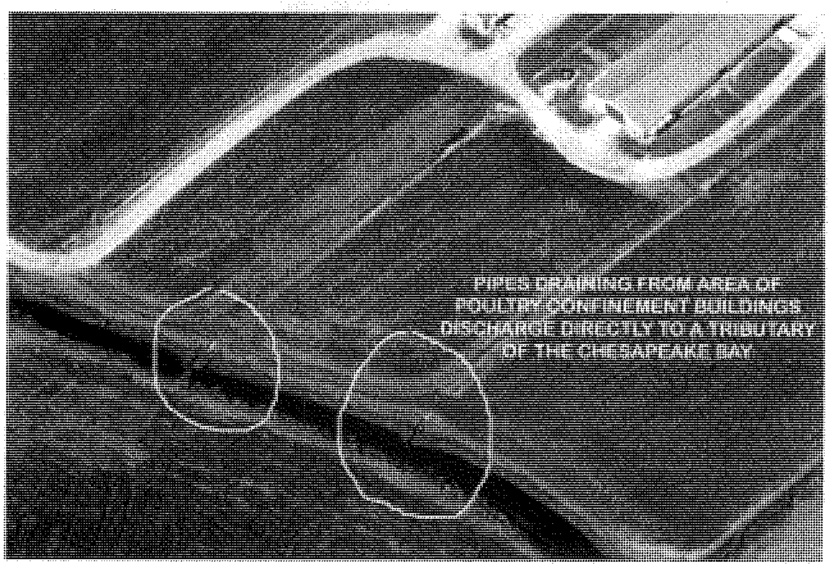
Hurricanes and heavy rains cause massive pollution problems from swine facilities in the North Carolina floodplain



A local businessman posts a sign in protest
of swine pollution and dying fish. Hwy 70, New Bern, NC

For more pictures, please visit
www.neuseriver.com


Raw hog feces and urine
being sprayed here
Animal waste
being discharged
to a blueline stream
here
12:45 PM 02/28/07
N34 52 305
W078 05 004


PIPES DRAINING FROM AREA OF
POULTRY CONFINEMENT BUILDINGS
DISCHARGE DIRECTLY TO A TRIBUTARY
OF THE CHESAPEAKE BAY

Senator BOXER. Thank you so much.

Let me take my 5 minutes. I think I'd like to take 7 minutes, then give 7 minutes to Senator Inhofe.

Let me just say, Mr. Dove, I thank you so much for your testimony because you speak for me here. We are not asking to pass new regulations or anything of that sort. When I say we, those of us who believe that we shouldn't make an exemption for this kind of waste.

We are just saying keep the law the way it is. The clean actors, and I would ask Mrs. Chinn, you have not been sued, have you, under this law?

Mrs. CHINN. It is my understanding that my farm does not fall underneath CERCLA.

Senator BOXER. Right, good.

Mrs. CHINN. But my family has a comprehensive nutrient management——

Senator BOXER. Whoa, whoa, whoa. I don't have time. You have never been sued under the laws, right?

Mrs. CHINN. No, because we abide by the laws. There are bad actors, and they should——

Senator BOXER. That is my point, Mrs. Chinn, if you might. You were very eloquent. I need some time here to make my point.

I think that is the point. There are wonderful good actors, families like yours, that we all support.

Look, I come from the largest ag State in the union. Our ag industry is not only a plus; it is our heritage. It is our heritage. So our people want to keep it that way, and they want to keep a good name for ag. That is why our attorney general along with many others have stated, please don't exempt these big concentrated animal farm organizations from the law.

What is happening, just to put it on the table, is there are those who are trying to do that in the Farm Bill. The reason I called this hearing is my concern. I certainly don't speak for everybody on the Committee. I haven't even polled the Committee, but I wanted to have this hearing to make the point.

Now, Mr. Dove spoke about the bad actors, what is happening. We have a picture. We actually took it off your website. We will show you.

First of all, if we could put up again the beautiful of Mrs. Chinn's operation which speaks for itself, and we will show you a lagoon in one of these bad actors' back yards. There you go. You can see the holding ponds, how clean they are, right?

Well, take a look at this. This is from a concentrated animal feed operation. It is not a family farm. It is industrialized agriculture, and the color pink comes about from the combinations of the bacteria and the poisons here. Indeed, the spraying, you can see the sprays going on.

Why, in God's name, would we ever want to expose the people to this kind of situation? It is just terrible.

The beautiful, idyllic picture that was painted by Mrs. Chinn is one I agree with. I have seen it in farm after farm, in operation after operation in my State, the good actors. God bless them, and we will protect them from any damaging kind of regulation.

But these bad guys or these corporate farms that have no heart and soul, that could care less, let me tell you what happened in the Midwest, your neck of the woods. At least 24 people in the Midwest have died.

I quoted you. It was a very beautiful quote about how from the farm to the fork, I think you said, it is the greatest.

Well, it is usually the greatest, but it isn't the greatest here. Twenty-four people in the Midwest died from inhaling hydrogen sulfide and methane from manure since the seventies including fifth generation Michigan dairy farmer, Carl Theuerkauf, and four members of his family who collapsed one by one in 1989 after breathing methane gas.

But the death toll from manure may be much higher. Cryptosporidium, a microorganism found in animal waste, killed 104 people and sickened 403,000 in Milwaukee in 1993 in an outbreak, some blamed on manure from nearby livestock farms.

A local health department and the Centers for Disease Control and Prevention suspected manure caused seven miscarriages in a small farming community in Indiana between 1991 and 1993 by contaminating wells. "I thought the water I was drinking was good water," said Melissa Dickerson, who was 22 and pregnant at the time.

So, from my standpoint, we have a problem here. We have the supersizing of America's livestock farms.

We have a good law that says for the normal application of manure, you are fine. You just do that. But when it gets to be 25,000 animals, 1,000,000 animals, it causes a different situation, and people are dying.

This isn't some romantic notion about let our farmers farm. This is about big corporate industrial size farms. No one wants to go after the good actors.

Professor Dicks, my question for you is because I agree with you very much that we need to treat manure as a valuable resource. I think methane digesters are one great example of this type of technology that helps to reduce pollution while increasing a farm's bottom line.

Do you agree that CAFOs should be making better use of manure as a resource and should stop treating manure like a waste and disposing of it by simply dumping it on the ground?

You said it shouldn't be looked at as a waste, and I agree with you. Don't you think they should stop dumping on the ground in excess amounts so that it contaminates our lakes, our rivers, our streams and our groundwater?

Wouldn't that be the solution to all of this, sir?

Mr. DICKS. Well, Senator, I am not going to agree or disagree with you. What I will say is that——

Senator BOXER. Well, I quoted you. You said it should be treated as a resource.

Mr. DICKS. I will say that most of these operations are going to do what is in their best interest, and they are going to go the universities. They are going to go to the government, and they are going to look to them for guidelines on what they should do.

They are going to ask the Natural Resource Conservation Service what they should be doing with the nutrient. If the best management plan that they give them is to spread it or to land applicate it, that is what they are going to do.

Senator BOXER. Yes, and if it winds up looking like this and getting people sick, that may not be the right thing, and that is why we need this law, this Federal law to underscore that we hold people accountable. This Superfund is not a regulation. It simply gives people the right to know and the right to take action if a member of their family dies or they get sick.

For the life of me, I don't get how people who say they are fans of agriculture could be against that when it could undermine the faith that this Country has in its food.

The last thing I want to do is put into the record an editorial from the Idaho Statesman. This is a part of our Country that couldn't be more conservative. The Barbara Boxers of the world simply don't seem to get many votes in that part of the world.

Let me tell you what they said. As the dairy industry continues to grow, the U.S. Department of Ag estimated the June dairy cow count at 486,000. The larger operations should be required to report their environmental impacts.

They quote a woman, Courtney Washburn of the Idaho Conservation League: Public health doesn't distinguish between the source of the pollution. Large livestock operations described by critics, accurately enough, as factory farms—and this is the paper talking—can release tons of ammonia among other pollutants.

This very conservative part of the Country, in the Idaho Statesman's words, says: Critics rightly want ag operations covered by the comprehensive Environmental Response Compensation and Liability Act, known as Superfund and the Emergency Planning and Community Right to Know Act which require large industries to report pollution to Federal and local agencies.

[The referenced material can be found on page 147.]

Senator BOXER. For me, this hearing has been tremendous because I have heard the opponents of keeping the law the way it is; I have heard the proponents.

In my view, I have always said, the best road to follow is protecting public health because when you do that, everybody wins. Agriculture wins. The people win. We don't have stories like yours, Mr. Dove, of sadness in families that can no longer use the resources.

So I thank you very much, and I would add a couple minutes on, giving Senator Inhofe 9 minutes.

Senator INHOFE. That is fine. Thank you, Madam Chairman.

You know one thing about this Country, there is such a plethora of publications around that you can always find extreme examples to use. I have done it myself.

But I look upon these hearings as more hearings, hearing from you guys. So that is why I am pleased that we are having this second panel. Again, I thank you for your patients in coming back.

Mrs. Chinn, Mr. Dove raises questions about property values, and you heard his testimony. I think Mr. Nemec spent about 5 minutes talking about how lousy some of the life is in some of these areas.

I would ask you first, do you live on your farm?

Mrs. CHINN. Yes, sir. All of my family lives on our farm, and we are proud of that.

Senator INHOFE. I saw in the picture there, you have a boy and a girl?

Mrs. CHINN. I have a son and a daughter.

Senator INHOFE. A son and a daughter, OK. Well, that is a boy and a girl, yes.

[Laughter.]

Senator INHOFE. I would like to know. It sounds to me like that you are a very conscientious person.

Now you are using land application, I would assume, aren't you?

Mrs. CHINN. Yes, we do, sir.

Senator INHOFE. What about property values? You are in northeastern Missouri?

Mrs. CHINN. Yes, we are in northeastern Missouri. In the last 5 years around our farm, there have been six brand new homes built, and these are people who have lived there all of their lives. They know we are there. They are not afraid of us.

The farm that adjoins the farm you see in that picture was up for sale last year. It sold for $300 an acre over the appraised value, which was 18 percent above appraised value. The farm that adjoins that one sold this last summer for over $650 per acre over the appraised value, which was 33 percent above appraised value. So we are not seeing property values go down in our area because of our livestock farm.

The house that you see in that picture is where my husband was raised. This year alone, the property value increased $25,000 on that house.

Senator INHOFE. That is good.

You just heard Professor Dicks talk about the return on investment for farmers and how at some point the costs of complying with regulations will outweigh the income derived from farming. Farmers, unlike many U.S. workers, have to invest in their business and spend a great deal of their working lives in debt, paying for their capital assets.

Without asking you to go into any detail about your personal finances, can you speak about the return on investment for farmers and how much of their income is actually invested in their facility? Do you have anything off the top of your head?

Mrs. CHINN. We have a very small return on our investment, and everything that we have goes directly back into our farm. The only thing we take out is what it costs us to live, to feed our children and to provide a roof over their heads and clothes on their backs.

Our entire life is what you see there in that picture, and our dream is to some day be able to give that to my children. So we invest everything that we have back into that operation, but our operating margin is extremely small. It is tight.

Senator INHOFE. Professor Dicks, you have probably heard this before, but you brought up something when talking about the cost of regulations. You have heard my story of one of the reasons I am here today is I spent 30 years out in the real world, getting beat up.

Some of the over-regulation, I think it is very costly but makes us non-competitive. I remember one time I was doing a development in south Texas and I had to go to 26 different governmental agencies to get a dock permit, and this is the information age.

Do you have anything you would like to share with us? Let us start off with the cost of regulations, anything you have come here with?

Mr. DICKS. No. No, sir, I haven't in specific. I will tell you that the cost of regulations is a major component of most agricultural operations, whether it is with respect to time and filling out forms.

Senator INHOFE. It is, and I think the best evidence of that is that when I became Chairman of this Committee—before the Democrats took control in January, I was Chairman of this Committee for 4 years—most of the ag community would come in and say what happens in this Committee is more significant than what happens in the Ag Committee because this is where they have a lot of these things.

I remember one time they were trying to make propane a hazardous material. We would have another layer of bureaucrats crawling all over every farm in my State of Oklahoma. The cost is just unbelievable. In fact, there was testimony as to what the cost would be to each family at that time just on that one bill. It was $700 a year, oddly enough.

Is the group that you have represented, Chris, associated with ag leadership?

Mrs. CHINN. Yes, we are. We do develop leaders in agriculture.

Senator INHOFE. OK. I remember in this very room, a bunch of people coming in, wearing red coats—I didn't know who they were—just about the time that we killed the bill in the Committee that would have had that application to propane, and they stood up and they cheered.

Afterwards, they said, this is the first time we realized what you are up against here in Washington.

Well, let me get to another thing. Professor Dicks, I am very, very proud of OSU and all the research they have done, what they are doing with sorghum and biomass, and you guys are just light years ahead of many other research operations.

If you look past the manure as a waste product and you were to eliminate as a land application, what would be the initial consequences?

Mr. DICKS. Well, I think it would be devastating. There simply isn't an option right now that is economical other than land application.

You understand the problem is that we have developed all these systems with that end in mind. So all the systems, all the facilities have been designed and developed so that we can eliminate that waste through land application. In order to move to the next stage, we have to totally redesign those systems and how we collect the manure.

Senator INHOFE. When you look at something like this, the pink water up here, why is it that I don't see that in Oklahoma?

Mr. DICKS. It has to do with how they manage that lagoon, and it has probably not been managed well.

Senator INHOFE. Yes, and that can happen. It can happen in Oklahoma. It could happen anywhere else. Maybe we are blessed with people who are more concerned about their property and the environment than maybe some of the others are.

Have you seen anything that extreme, Mrs. Chinn?

Mrs. CHINN. No, I have not. In Missouri, we have strict rules and regulations that we must follow. Often, our State rules are more restrictive than the Federal regulations upon us.

Senator INHOFE. So you can continue to use a land application of manure.

Mrs. CHINN. Yes, we do.

Senator INHOFE. And still have that level of pristine results that you are getting.

Mrs. CHINN. Yes, we do. We follow all of our DNR rules and regulations and our guidelines. We use best management practices, and we don't have a problem like that.

Senator INHOFE. You use land application yourself and you probably, with your operation, sell it to others too, is that correct?

Mrs. CHINN. Actually, we are not fortunate enough to sell it. We give it away to be a good neighbor because it is important to us to reinvest in our community. If our row crop farmers can't afford to produce corn, we can't afford to feed our hogs. So we work in close partnership with all of our local farmers, and we give that nutrient away to be a good neighbor because we are in this together as a team.

The cost for labor in our area is high. We have 40 employees, and the average salary for our employees is $36,000 a year. The median salary in my county for a male is $25,900.

We have long term employee retention. We do not use immigrant labor. It is all local community.

Senator INHOFE. What would you use to substitute the land application of manure if that were taken away?

Mrs. CHINN. What would we use if we couldn't use manure?

Senator INHOFE. Yes.

Mrs. CHINN. Well, our grain farmers would be forced to buy commercial fertilizers, and I have no idea what would happen to my family farm if we couldn't do that anymore, what we would do with our nutrients. Probably, we couldn't afford. I know we couldn't afford to relocate to a foreign country, so we would more than likely go out of business.

Senator INHOFE. Of course, about 90 percent of the cost of fertilizer is natural gas. We see what is happening there.

Mrs. CHINN. Correct.

Senator INHOFE. Therefore, it gets passed on ultimately, I suppose, to the customer.

Mrs. CHINN. Right, but we can't pass it on to our customer.

Senator INHOFE. I appreciate very much your coming all the way from OSU. That is where I enjoyed an evening 6 days ago.

Dr. Dicks, is there anything else that you can think of that you feel you would like to share in this hearing, perhaps that was in your written statement that you didn't get a chance to talk about?

Mr. DICKS. I think two things I want to touch on briefly. One is this idea of the structure of agriculture that Senator Boxer has brought up. If we have a problem with the size and concentration of the industry, we should attack that head-on.

To have a regulation about waste or to have payment limitations or any other means to try to deal with the structure of the agriculture problem, that is going to produce lots of downstream impacts that probably are unintended. If we have a problem with the structure of agriculture, we need to approach that problem directly and not through some sidebar.

My problem with having animal manure classified as a hazardous material is exactly what Senator Bond said. Once you do that, it puts stops on every other type of utilization of that product. I am all about trying to figure out how to utilize that, how to collect it, how to utilize it, how to make valuable products out of it.

You make that a hazardous waste; you have a real problem with doing that.

Senator INHOFE. That is a very good statement.

I appreciate the time of all of you.

Mr. Dove, I thank you for your service in the United State Marines. I hope you are watching the successes we have had in Fallujah where the Marines went door to door, World War II style, and it is now totally under the ISR security right now. Your Marines are still performing. Thank you very much.

Senator BOXER. Senator Inhofe, I am going to make some closing statements. I am going to take about 5 minutes. Would you like to make some additional closing statements?

Senator INHOFE. No, I don't think so. I do have a commitment, that I have got to make a live address in 7 minutes.

Yes, I do have one last request here.

Senator BOXER. Go ahead, please.

Senator INHOFE. For the record, we have four things to ask to be included in the record. One is a brief filed by the State of Texas in the city of Waco lawsuit; second, a letter sent to the Committee last year by a farmer sued by the city of Waco; third, an executive summary of a study done by Lake Waco; and, last, descriptions of agriculture programs in New York and California.

I ask unanimous consent they be made a part of the record of this Committee hearing.

Senator BOXER. They will be made part of the record, Senator.

Senator INHOFE. Thank you.

[The referenced material can be found on pages 153, 183, 240, and 214.]

Senator BOXER. All right, so we are going to bring this to a close, and I have a final statement.

I think that, Mrs. Chinn, of all of our witnesses, you proved my point which is that the good actors aren't troubled by our laws and shouldn't be. They go right ahead, doing the right thing, and everyone is happy around them.

But the bad actors are troubled. They are troubled. Now they can hide behind the good actors all they want, but we are going to tell the truth about the situation. The truth will be told, and it will be told here as I make sure that this record is complete. It will be told to the members of the Ag Committee, who may want to take some of our jurisdiction and weaken our laws.

It will be told on the U.S. Senate floor, and if I have to stand there through the night, telling the stories about this, I will. So those people who want to weaken these laws, I hate to say it, but

I am ready. I am ready to take this on, and I will have a lot of friends with me.

Some of those friends are the U.S. Conference of Mayors who say don't weaken our laws, the National Association of Counties who say don't weaken our laws, the National Association of City and County Health Officials who say don't weaken our laws, the American Public Health Association, the National League of Cities, the American Waterworks Association, the Iowa Department of Natural Resources, the city of Waco, the city of Tulsa, Oklahoma, the Institute for Ag and Trade Policy, the National Environmental Trust, the Sustainable Ag Coalition, Food and Water Watch, attorneys general from eight States, the National Association of Clean Air Agencies, the American Metropolitan Water Agencies, the Natural Resources Defense Council, the Sierra Club, the Union of Concerned Scientists, Environmental Integrity Project, Earth Justice, the Humane Society of the U.S., U.S. PIRG Environmental Working Group, Western Organization of Resource Councils, Waterkeeper Alliance who I think we heard a good voice from them, the Walton League of America.

Here is the point. There are lots more, but this is just what I have been able to pt together for today. This is going to be a fight.

The hearing that I heard, the witnesses I heard from today, all helped me and gave me information, starting with Mrs. Chinn, the first panel and going through. All of you, wonderful witnesses, really helped me today, and for that I am grateful.

This morning, I didn't have time to share with you an article that appeared in the Kansas City Star. So I am going to go and read some of that to you and for the record. This is not 10 years ago or 5 years ago or 1 year ago. This is August 3d, 2007, this article.

One winter day this year, Sandra Heasley was taking a shower and suddenly the water turned to dark brown and a revolting smell filled the bathroom.

I want everyone to think of this as a family. It turns out her home in West Plains in southern Missouri is across the road from a large indoor dairy farm where manure was piled several feet deep outside.

The experience was a nightmare for Heasley who said she took to her bed for a week.

Can you imagine getting in a shower and having cow manure come through the shower head, the 62-year-old woman asked.

This week, Missouri Attorney General Jay Nixon filed a lawsuit against the owners of the dairy, alleging violations of the State's Clean Water Law. The lawsuit comes after years of complaints from neighbors.

Manure was being stacked several feet deep in pastures and dumped along Route K in a creek bed, according to the Missouri Department of Natural Resources.

The farm used what is known as a traveling gun. This is what you described to us, Mr. Dove.

This is all new to me. I am a city kid. I represent an ag State, but I admit I grew up in the city.

They used a traveling gun to shoot the manure up into the trees, the report says.

The flies are so terrible here. They line up on a wire in the barn just solid, said Larry Swendener, a neighbor who says his well is contaminated.

It is atrocious. These are good families too.

Neighbors soon complained to the Natural Resources Department about the pungent odor of cow excrement and swarms of flies. At least two neighbors told the State their wells were contaminated.

Several neighbors said they didn't want to see the farm go out of business, but they wonder why it has taken so long to protect their health and their property values.

The Howard County Health Department says there is no doubt the Heasley well is contaminated with E. coli.

Safe from the farm to the fork? E. coli and coliform, bacteria that comes from fecal matter.

Justin Frazier, the Health Department's Environmental Supervisor, tested Heasley's water in early February.

This story goes on and on. If anyone is interested, they can finish reading it.

Then you have the Salt Lake Tribune, another area that is not known for its Democrats. I don't think we have seen a Democrat from that State in the Senate in a long time. This is what they say.

Manure Factories Don't Rate Protection, Politics Stink, Salt Lake Tribune: When is the fecal matter produced by thousands of cows, pigs or chickens not an environmental hazard? When Congress says it isn't, which is exactly what will happen if the bill with the sickeningly sweet title of the Ag Protection and Prosperity Act becomes law.

Always watch out when you see those titles.

While things like stopping nuclear waste in Utah draw the press, environmentally destructive nonsense like this Cow Poop Is Good For You Law move quietly forward.

The 1980 law known as Superfund scares the owners of giant animal feeding operations because it allows government to go after polluters after the fact and hold them responsible for the stinking mess they or their corporate ancestors make.

Saying that manure isn't a pollutant is part of the usual agribusiness scam, pretending that they are engaged in benign animal husbandry and shouldn't be micromanaged by government. But the stuff isn't supposed to flow out of huge protein factors, but sometimes it does.

It is not fertilizer for the garden. It is an industrial scale pollutant reeking with ammonia, nitrogen and phosphorus, carrying antibiotics and synthetic hormones, fouling water supplies and creating giant dead zones in coastal waters.

The environmental credentials of anyone who would exempt this from environmental regulations are hardly credible.

So I am going to put that in the record, the Idaho Statesman article in the record and there is the Plain Dealer called Looking Out for the Farmer Who Lieth and the Register-Guard, Unlovely Lagoons. I am putting that all in the record for you to read.

[The referenced material can be found on pages 146 and 148:]

Senator BOXER. I think that the die is cast here. We have a law that is working. It could work better. We certainly don't want to weaken it.

We need to protect the public health and safety. If there is one thing I care about, it is that. You know who is the most impacted when we do the wrong thing, our children, because of who they are, because their bodies are changing and they are very sensitive. That is where they are like the canary in the coal mine, and that is why you see asthma in our kids. It is clear: they are impacted first.

What kind of people are we to turn away from what has to be done which is making sure that our farms thrive but they do it in an environmentally responsible way?

Look, I come from a State that is on the cutting edge of environmental protection. Guess what? We are the most prosperous State. Guess what? We have grown the most.

Guess what? We have a great ag industry, more specialty crops than anybody, 200, 300 hundred different crops in our State. We do fine. We have tough laws. We have tough rules. Our attorney general says keep the Federal law. It is important.

So I would just urge all of you who have come out today, who have said weaken these laws, to rethink what you are doing. Ask yourself, deep in your heart, if you are doing it for the right reason or you are doing it for the wrong reason.

The wrong reason is to exempt a whole industry for a reason that makes no sense by redefining what a dangerous waste is. That is not the way to go.

I had a hearing on infrastructure in my State. Actually, there was an expert there who said: I have a way out of the problem. Let us just change the language. Let us just say these bridges we said are structurally deficient. Just change the language and don't call them that anymore, and the problem will go ahead.

I don't think so. I don't think if you call that bridge in Minnesota something else, it wouldn't have collapsed.

Well, I don't think you stop people from getting sick, some even dying and taking a shower in brown water and that is going to go away if we suddenly redefine ourselves out of this problem by saying, oh, well, yes this is a waste over here, but it is not really a waste over there. This is dangerous when it is over here, but it is not dangerous over there. We need to be just frank and honest with each other here.

This is going to be a battle. I wanted to have this hearing today to draw the lines of that battle. I hope maybe they will go away, and they won't try to weaken these laws.

But I ask each and every one of you to think to yourself: What would you do if you were in my shoes and your first priority was to protect the health and safety of the people? What would you do?

Think about that and know that all four of you have added immeasurably to this debate, and I thank you all from the bottom of my heart, and we stand adjourned.

[Whereupon, at 3:05 p.m., the committee was adjourned.]

May 4, 2006 Cleveland, Ohio

THE PLAIN DEALER

Looking out for farmer Goliath

Some members of Congress want to build a legal moat around polluting mega-farms to protect them from big, bad cities that want to punish them.

More reasonable lawmakers should block this measure. The issue is particularly relevant to Ohio, because some factory farms are applying for expansions.

So far, at least 130 House members have signed on to exempt huge farms from tougher pollution controls, including Republican Reps. Ralph Regula of Navarre and Jean Schmidt of Cincinnati.

Supporters of the legislation argue that huge farms are not factories and thus not subject to stringent regulation under the Superfund, also known as the Comprehensive Environmental Response Compensation and Liability Act of 1980. Superfund makes companies pay to clean up environmental damage.

Cities raised the ire of industry recently by threatening to take companies to court under Superfund regulations if they did not clean up after themselves. The threat worked.

Now, agribusiness and its supporters are crying foul. They say Congress wrote the Superfund law to punish industrial polluters, not farmers.

That's missing the point.

Although it's true that farms contributed far less to pollution 25 years ago, the point of the Superfund regulations was to combat pollution, whether from smokestacks, swine or any other source.

The courts may have to decide whether the Superfund applies. But Congress should not rush to protect factory farms from the consequences of their actions. Cities seeking just compensation for environmental damages don't need a moat blocking their way.

August 1, 2006 Boise, Idaho

The Idaho Statesman

Pollution exemption for dairies stinks

Big Livestock in Idaho just keeps getting bigger. Idaho dairies produced 923 million pounds of milk in June — up 7.7 percent in one year, and fourth among 23 major dairy states.

As the industry gets bigger, so too do the dairies and the pollution problems attached.

So it is disappointing to see Idaho's two senators back a bill to give farmers and ranchers cover from federal environmental law.

If Sens. Larry Craig and Mike Crapo get their way, manure would no longer be defined, for purposes of Superfund law, as a "hazardous substance, pollutant or contaminant."

At the risk of bathroom humor, this idea flunks the smell test.

Large livestock operations — described by critics, accurately enough, as factory farms — can release tons of ammonia, among other pollutants.

Ammonia is not merely a malodorous nuisance; it can aggravate respiratory problems or lead to a burning in the eyes or throat. These health effects have nothing to do with legal definitions and everything to do with ammonia's physical characteristics.

"Public health doesn't distinguish between the source of the pollution," said Courtney Washburn of the Idaho Conservation League.

ICL and other critics rightly want ag operations covered by the Comprehensive Environmental Response, Compensation and Liability Act — better known as Superfund — and the Emergency Planning and Community Right-to-Know Act, which require large industries to report pollution to federal and local agencies.

Craig and Crapo say they are not trying to roll back the rules. They argue that they are merely trying to clarify the law — and instruct judges that Superfund was never written to regulate manure.

Why not? People living next to a dairy or feedlot — in small communities all across the state — should not have to settle for less protection than folks living near a Rust Belt industrial plant.

That's what this ill-founded protection of agribusiness would do, and it's counterintuitive to market reality.

The livestock industry has changed considerably since Superfund's passage in 1980. Dairies and feedlots are being built larger to compete in a more volatile global economy. In 1982, 178,082 head of cows were found on 4,199 Idaho dairy farms. Two decades later, the number of cows had more than doubled to 390,000, but the number of farms had shrunk to 950.

As the dairy industry continues to grow — the U.S. Department of Agriculture estimated the June dairy cow count at 486,000 — the larger operations should be required to report their environmental impacts.

Regrettably, too many members of Congress see it differently.

Craig in 2004 and 2005 tried to tack riders onto other bills, saying Superfund law and the right-to-know act do not apply to manure. A House bill, introduced in November, pushes the same exemption; Idaho Reps. Mike Simpson and C.L. "Butch" Otter are cosponsors. Sen. Pete Domenici, R-N.M., introduced his own identical bill last month. The powerful chairman of the Senate's Energy and Natural Resources Committee already has 25 Senate cosponsors, including rural Republicans such as Craig and Crapo.

Whatever the legislative vehicle, the net result still smells sour — especially to any Idahoan downwind of a large dairy or feedlot.

September 4, 2006 Eugene, Oregon

The Register-Guard

Unlovely lagoons

In recent decades, livestock and poultry production in the United States has undergone a transformation that has serious environmental consequences.

Traditional farms increasingly have been replaced by commercial animal growing operations designed to maximize profits through economies of scale. The largest 5 percent of these farm factories are called "concentrated animal feeding operations," or CAFOs.

Each year, CAFOs generate an estimated 300 million tons of manure containing an array of contaminants that seep into waterways and groundwater in 29 states, including Oregon. At Threemile Canyon Farms in Boardman, decomposing manure at the industrial mega-dairy emits thousands of pounds of ammonia each day into the air, contributing to haze and acid rain in the Columbia River Gorge.

At many CAFOs, manure is stored in sprawling sludge lagoons and eventually sprayed or applied as fertilizer. In recent years, major lagoon spills have been reported in a dozen states, including Washington.

Federal regulation of CAFOs has been notoriously weak, and individual states, including Oregon, have attempted, with only modest success, to regulate the industry. CAFO owners often attempt to dodge legal responsibility for waste pollution by requiring that local farmers assume responsibility for the waste. Such agreements haven't shielded them, however, from the federal Superfund program, which attempts to trace pollution to its original sources and to hold accountable all parties involved.

Now, the CAFO industry wants Congress to permanently exempt it from the Superfund liability and oversight. An industry coalition, ironically named Farmers for Clean Air and Water, is lobbying lawmakers to pass a bill that would bar federal officials from listing manure as a hazardous substance under the Superfund law.

Industry officials argue that the Superfund law was intended to regulate industrial sites such as the Love Canal - or, in Oregon, the Willamette River's Portland Harbor - rather than agricultural operations. One industry press release notes that manure is "naturally occurring" and "not a Superfund material." It ominously warns that "everyone that uses the bathroom could be considered an open target for million-dollar lawsuits."

That's silly and manipulative. The Superfund law doesn't target manure production; in fact, it contains a provision exempting normal applications of fertilizer. However, the law does - and should - cover massive dumping of animal wastes that leads to the buildup of contaminants that meet the Superfund criteria of hazardous substances.

It's also misleading to suggest than manure should be exempted because it occurs naturally. Using that same reasoning, the EPA also should stop listing mercury and arsenic as hazardous substances.

Finally, the industry argues that CAFO pollution already is regulated under other federal regulations and environmental laws, such as the Clean Water Act. But most of those don't satisfactorily address CAFO pollution, are inadequately enforced or, as is the case with Clean Water Act, may soon be weakened by Bush administration rule changes.

Congress should dump the proposed Superfund exemption bill in the nearest waste lagoon. If anything, lawmakers should consider ways to strengthen existing laws to make certain CAFOs are held fully responsible for excessive dumping of animal wastes.

September 9, 2006

UTAH'S INDEPENDENT VOICE SINCE 1871

The Salt Lake Tribune

Politics stinks

Manure factories don't rate protection

When is the fecal matter produced by thousands of cows, pigs or chickens not an environmental hazard?

When Congress says it isn't. Which is exactly what will happen if the bill with the sickeningly sweet title of "The Agricultural Protection and Prosperity Act" becomes law.

While things like stopping nuclear waste storage facilities in Utah draw all the press, environmentally destructive nonsense like this cow-poop-is-good-for-you law move quietly forward.

In this case, they do so with the support of some of the same Utah politicians who are now basking in the green glow of having stopped the planned Private Fuel Storage nuclear waste plan for Utah's Skull Valley. Sen. Orrin Hatch is a recent addition to the list of the bill's co-sponsors in the Senate. Reps. Rob Bishop and Chris Cannon lent their names to the House version back in the spring.

It's a short bill that, despite its deceptive name, comes with a clear explanation of its intent: "To amend the Comprehensive Environmental Response Compensation and Liability Act of 1980 to provide that manure shall not be considered to be a hazardous substance, pollutant, or contaminant."

That 1980 law, also known as the Superfund Act, scares the owners of giant animal-feeding operations because it allows government to go after polluters after the fact and hold them responsible for the stinking messes they or their corporate ancestors have made.

Saying that manure is not a pollutant is part of the usual agribusiness scam, pretending that they are engaged in benign animal husbandry and shouldn't be micromanaged by government. But the stuff that isn't supposed to flow out of huge protein factories - but sometimes does - is not fertilizer for the garden.

It is an industrial-scale pollutant, reeking with ammonia, nitrogen and phosphorus, carrying antibiotics and synthetic hormones, fouling water supplies and creating giant dead zones in coastal waters.

It's not as sexy as one nuclear waste dump, but the proliferation of these manure factories actually threatens more communities with more imminent harm. The environmental credentials of anyone who would exempt them from environmental regulations are hardly credible.

Kansas City Star

Kansas City Star, The (MO)
as provided by Knight-Ridder Digital

August 4, 2007

Neighbors say nearby dairy farm contaminates their wells with manure

Author: KAREN DILLON, The Kansas City Star
Edition: 1
Section: FRONT
Page: A1
Article Text:

One winter day this year, Sandra Heasley was taking a shower when suddenly the water turned a dark brown and a revolting smell filled the bathroom.

It turns out her home near West Plains in southern Missouri is across the road from a large indoor dairy farm where manure was piled several feet deep outside.

Health officials cannot say with certainty that the manure got into Heasley's well water, but they do say Heasley's water was contaminated and it smelled strongly like cow manure.

Heasley and her neighbors have no doubt. In fact, the experience was a nightmare for Heasley, who said she took to her bed for a week afterward.

"Can you imagine getting in a shower and having cow manure coming through the shower head?" the 62-year-old woman asked.

Bill and Fran Collins, who own the farm, concede they have problems with the waste management system for cow manure, and they blame federal government engineers who helped install it.

They say Heasley's problem is not their fault and their own wells are not contaminated. They say Heasley is "nit-picky."

"We haven't done anything wrong, bu! t they act like we did," Fran Collins said. "I want to tell you that that woman's well over there is probably not contaminated from us."

But this week Missouri Attorney General Jay Nixon filed a lawsuit against Bill Collins and Collins

Dairy alleging violations of the state's clean-water law.

The lawsuit comes after years of complaints from neighbors.

The Collins Dairy Farm began a mostly indoor dairy operation in 2002 with a grant of $218,467 from the Natural Resources Conservation Service, an agency within the U.S. Department of Agriculture. That agency also provided engineering assistance to build the waste management system.

The system allows the cows to spend most of the time in a feeding barn. Animal waste is moved from the feeding barn to two large pits and overhead tanks.

But the Collinses had trouble operating the system, and soon manure was being stacked several feet deep in pastures and dumped along Route K in a creek bed, according! to Missouri Department of Natural Resources reports. The Collinses al so used what is known as a traveling gun to shoot the manure up into trees, the reports said.

"The flies are so terrible here, they'll line up on a wire in the barn just solid," said Larry Swendener, a neighbor who said his well is contaminated. "It's atrocious."

Neighbors soon complained to the Natural Resources Department about the pungent odor of cow excrement and swarms of flies. At least two neighbors told the state their wells were contaminated.

Several neighbors said they don't want to see the farm go out of business, but they wonder why it has taken the Natural Resources Department so long to protect their health and their property values.

Department officials say that they have tried to work with the Collinses to persuade them to comply with state law. Twice the agency has cited the dairy.

Doyle Childers, department director, said in a letter to Heasley last month that the department is doing everything it can. Officials said this week ! that they have stepped up inspections to once a month.

The lawsuit filed this week says the Collins Dairy operation and its animal-waste holding pits are "water contaminant sources."

In addition, it says, Collins Dairy has discharged the waste into a tributary of Spring Creek since July 2005.

The dairy farm faces fines up to $10,000 for each day it violates the clean water law.

The Howell County Health Department says there is no doubt that Heasley's well is contaminated with E.coli and coliform, bacteria that come from fecal matter.

Justin Frazier, the Health Department's environmental supervisor, tested Heasley's water in early February.

"You could turn the water on, and it would get a filmlike froth on the top of it," Frazier said. "It's the worst-smelling water that I've actually done testing on."

After Heasley showered in the brown water, she said, she had no way to wash the contamination off.

Her daughter took her to a camping! area to shower.

She began buying water. To bathe, she heated it on the stove and then carried it to the bathroom in a dishpan while using a cane to walk.

Heasley also has been pouring chlorine in her well and using a filter, and the Health Department said this week that the water coming into her house is clean, although the well remains contaminated.

Ultimately, Heasley and some neighbors think they will need new wells, but that is expensive. Heasley's income comes from a $600 a month disability check.

Frazier said he could not be absolutely sure the farm was responsible for contamination without further water testing.

"You can't be 100 percent sure, but the dairy farm is right across the road from her," he said.

Fran Collins denies responsibility for contaminating the well but agrees the farm was having a problem with the waste management system last winter.

Government engineers told them to leave the manure in the pits, she said, but that was bad advice in the middle of winter.

"S--t freezes,"! Fran Collins said. "These cows don't stop s--ting because (the pits) are full. You cannot haul it out when it is frozen. The only option was to put it on the ground. So we put it on the ground."

Record Number: 200708040001KNRIDDERMOKCITYS_shower_080407

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

THE CITY OF WACO,	§	
Plaintiff,	§	
	§	
v.	§	**CIVIL CAUSE NO. W-04-CA-118**
	§	
DENNIS SCHOUTEN, et al.	§	
Defendants.	§	

BRIEF OF AMICUS CURIAE
TEXAS DEPARTMENT OF AGRICULTURE
IN SUPPORT OF DEFENDANTS' MOTIONS REGARDING
DISMISSAL OF CERCLA CLAIMS

GREG ABBOTT
Attorney General of Texas

BARRY R. McBEE
First Assistant Attorney General

EDWARD D. BURBACH
Deputy Attorney General for Litigation

KAREN W. KORNELL
Assistant Attorney General
Chief, Natural Resources Division

ANTHONY GRIGSBY
Assistant Attorney General
State Bar No. 08491500

ATTORNEYS FOR AMICUS,
TEXAS DEPARTMENT OF AGRICULTURE

October 13, 2005

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

THE CITY OF WACO,	§	
Plaintiff,	§	
	§	
v.	§	**CIVIL CAUSE NO. W-04-CA-118**
	§	
DENNIS SCHOUTEN, et al.	§	
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BRIEF OF AMICUS CURIAE
TEXAS DEPARTMENT OF AGRICULTURE
IN SUPPORT OF DEFENDANTS' MOTIONS REGARDING
DISMISSAL OF CERCLA CLAIMS

TO THE HONORABLE WALTER S. SMITH, JR.:

The Texas Department of Agriculture supports the motions urging dismissal of claims under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The plain meaning and histories of the pertinent statutes and regulations establish as a matter of law that the listing of phosphorus as a hazardous substance includes only phosphorus in its elemental state.

STATEMENT OF INTEREST

The Texas Department of Agriculture (TDA), pursuant to Texas Agriculture Code § 12.002, is charged to "encourage the proper development of agriculture" throughout Texas. The Commissioner of Agriculture, Susan Combs, serves as vice-chair of the Texas Agricultural Policy Board, which the Texas Legislature created to provide information and guidance relating to the state's agricultural policy to lawmakers and other interested parties.

TDA is an active partner with state and federal agencies — for example, the U.S. Department of Agriculture, the Natural Resources Conservation Service, the Texas State Soil and Water Conservation Board, and the Texas Commission on Environmental Quality — in projects to investigate the impact of agricultural activities on natural resources and the environment and to develop and promote sound, sensible, and environmentally-responsible practices by the agricultural community.

No fee has been paid or is to be paid for preparing this brief.

FACTUAL BACKGROUND

The element phosphorus (chemical symbol: P; chemical formula: P_4) is toxic and highly reactive; it burns when exposed to warm air.[1] Elemental phosphorus does not occur naturally; industries produce it, typically from phosphate rocks,[2] for use as a feedstock to manufacture munitions, pesticides, fertilizers, and other chemicals.[3] The primary environmental exposure is to workers at or residents near manufacturing facilities or military training exercises or to people who ingest rat poison or fireworks.[4]

Because elemental phosphorus is so highly reactive with oxygen, when released to the environment it quickly forms relatively harmless chemical compounds.[5] It typically persists

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[1] EPA *Phosphorus Hazard Summary* (2000), http://www.epa.gov/ttn/atw/hlthef/whitepho.html 3. A copy of the hazard summary is in App. A. References to pagination are to the printing in the appendix.

[2] Agency for Toxic Substances & Disease Registry (ATSDR), *Toxicological Profile for White Phosphorus* (Sept. 1997) §§ 1.1, 4.1. Selected pages of the profile are in App. B. The complete report may be viewed and downloaded at http://www.atsdr.cdc.gov/toxprofiles/tp103.html.

[3] EPA *Phosphorus Hazard Summary*, 1; ATSDR, *Toxicological Profile for White Phosphorus*, § 4.3.

[4] EPA *Phosphorus Hazard Summary*, 1; ATSDR, *Toxicological Profile for White Phosphorus*, §§ 1.3, 5.5-.6.

[5] ATSDR, *Toxicological Profile for White Phosphorus*, §§ 1.2, 5.3.

for a few minutes in the air, for a few hours in water, and for a few hours or days in soil.[6] However, if elemental phosphorous is sealed off from the environment, especially from oxygen (such as by being buried deep in anaerobic soil or sediment), it may persist much longer.[7] Elemental phosphorus has not been found in drinking water or in food (except fish and fowl near contaminated manufacturing or military sites).[8]

The primary non-military use of elemental phosphorus is to produce phosphoric acid and phosphates.[9] A phosphate molecule is one phosphorus atom surrounded by four oxygen atoms; the simplest phosphate is orthophosphate (PO_4^{-3}).[10] Phosphates and phosphorus are different and should not be confused. Phosphates are used in a wide variety of products, such as fertilizers (to nourish plants) and as a food additive (nourishing humans and animals).[11] EPA recommends adding orthophosphate to drinking water.[12]

Elemental phosphorus does not occur naturally.[13] In natural systems, such as soil and water, phosphorus exists as phosphate compounds, rather than in its elemental state.[14]

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[6] *Id.*

[7] *Id.*

[8] *Id.* § 1.3.

[9] *Id.* § 4.3.

[10] Univ. of Minn. Extension Service (UMES), *The Nature of Phosphorus in Soils*, (Univ. of Minn. Regents, 2002) at 1. The monograph is at http://www.extension.umn.edu/distribution/cropsystems/DC6795.html. A copy is in App. C.

[11] ATSDR, *Toxicological Profile for White Phosphorus*, § 4.3.

[12] EPA, *Fact Sheet: Orthophosphate, Drinking Water and Public Health* at 1. A copy of the fact sheet is in App. D. More information is available at http://www.epa.gov/dclead/.

[13] ATSDR, *Toxicological Profile of White Phosphorus*, § 1.1.

[14] UMES, *The Nature of Phosphorus in Soils* at 1.

Manure contains organic and inorganic phosphates,[15] not elemental phosphorus.

Many writers incorrectly use the word "phosphorus" when referring to phosphates.[16] As the Agency for Toxic Substances and Disease Registry noted:

> Phosphorus exists mostly in the phosphate form in the general environment. The levels of phosphorus determined in most environmental samples *are reported as total phosphorus and do not distinguish between elemental phosphorus and its compounds*. However, elemental phosphorus is far more toxic than other oxidized phosphorus states (oxides and acids of phosphorus).[17]

The City of Waco (Waco) in its pleadings and briefing confuses elemental phosphorus and phosphates. Waco does not complain about the toxic effects of elemental phosphorus. Rather, the essence of its complaint concerns over-nourishment of algae, which it says is responsible for incremental taste and odor problems in its drinking water.[18] Its reference to the listed hazardous substance elemental phosphorus as the nourishing substance, rather than to phosphates that are not listed, is wrong and inaccurate.

Several defendants filed motions to dismiss Waco's claims under CERCLA.[19] The Court entered interlocutory orders denying most of the motions, apparently agreeing with Waco's contention that cow manure is a mixture of a hazardous substance. The Hidden View Dairy defendants' motion to dismiss remains pending. Also, the AzTex Dairy defendants filed a motion for reconsideration and clarification of the interlocutory orders.

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[15] *Id.* at 3.

[16] ATSDR, *Toxicological Profile of White Phosphorus*, § 5.4.

[17] *Id.* (emphasis added).

[18] Third Amended Complaint ¶¶ 108, 111, 114.

[19] 42 U.S.C. §§ 9601-9675.

TDA supports the pending motions urging dismissal of the CERCLA claims.

SUMMARY OF THE ARGUMENT

The science underlying hazardous substance designations and the histories of the pertinent statutes and regulations show, as a matter of law, that cow manure is *not* a mixture of the listed hazardous substance, elemental phosphorus.

- Elements and compounds are chemically distinct. Elemental phosphorus (P_4) is distinct from the compound phosphate (PO_4). The Court should not treat elemental phosphorus and phosphate the same, any more than it would treat elemental hydrogen and water the same.
- Compounds and mixtures are different. The Court should not treat the compound phosphate as a mixture of elemental phosphorus. Cow manure is a mixture with phosphate compounds as constituent substances, not elemental phosphorus.
- EPA intended to list elemental phosphorus as a hazardous substance. It intended to regulate phosphates, such as those found in cow manure, as non-hazardous, non-toxic, non-conventional pollutants.
- Neither Congress nor EPA listed or intended to list all phosphorus compounds as hazardous substances — a conclusion supported by the case law.

Alternatively, if the proper characterization of cow manure under CERCLA were disputable, which TDA contends it is not, then the Court should refer the matter to EPA.

ARGUMENT AND AUTHORITY

I. The presence of phosphates in cow manure does not make cow manure a hazardous substance.

CERCLA defines a "hazardous substance" as a substance designated under various acts, including any hazardous substance listed under the Clean Water Act, any toxic pollutant listed under the Clean Water Act, and any hazardous air pollutant listed under the Clean Air Act.[20] Phosphorus is a listed hazardous substance under CERCLA because it was designated as a "hazardous substance" under the Clean Water Act and as a "hazardous air pollutant" under the Clean Air Act.[21]

A. Basic science supports the conclusion that phosphate is not the listed hazardous substance.

Congress directed EPA to identify the elements and compounds that are hazardous substances.[22] EPA included mixtures of those substances.[23] These terms — element, compound, mixture — have common scientific meanings that are part of everyday knowledge and understanding that shape statutory and regulatory construction.

1. Elements and compounds are chemically distinct.

"Element" is defined as: "A substance composed of atoms having an identical number

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[20] 42 U.S.C. § 9601(14). Congress enacted the Federal Water Pollution Control Act in 1941, but it has been commonly called the Clean Water Act since the 1972 amendments. It is at 33 U.S.C. §§ 1251-1387. The Clean Air Act is at 42 U.S.C. §§ 7401-7671q.

[21] 40 C.F.R. § 116.4 (Clean Water Act list of hazardous substances), 42 U.S.C. 7412(b)(1) (statutory list of hazardous air pollutants); *see also* 40 C.F.R. § 302.4, Table 302.4. The table compiles the six lists of substances that constitute CERCLA "hazardous substances." The statutory source column indicates that phosphorus is listed pursuant to the Clean Water Act and Clean Air Act.

[22] 33 U.S.C. § 1321(b)(2)(A). App. P contains copies of pertinent statutes.

[23] 40 C.F.R. §§ 116.3, 116.4. App. Q contains copies of pertinent rules.

of protons in each nucleus. Elements cannot be reduced to simpler substances by normal chemical means."[24]

"Compound" is defined as: "A pure, macroscopically homogeneous substance consisting of atoms or ions of two or more different elements in definite proportions that *cannot be separated by physical means*. A compound usually has *properties unlike those of its constituent elements*."[25]

For example, elemental hydrogen is a highly flammable gas.[26] Elemental oxygen is a gas essential to nearly all combustion.[27] But the compound H_2O is a liquid used to douse fires. Thus, a compound's properties can be the antithesis of its elements' properties.[28]

Similarly, a seventh grade science textbook states:

> An **element** is a substance that cannot be broken down into any other substances by chemical or physical means. . . .
>
> A **compound** is a substance made of two or more elements that are chemically bound together in a set ratio. One of the most common compounds is water, made from two parts hydrogen and one part oxygen. . . .
>
> The properties of a compound can be very different from those of its elements.[29]

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[24] *American Heritage College Dictionary* (4th ed., 2004, Houghton Mifflin Co.) 452. Excerpts of definitions are included in App. E.

[25] *Id.* at 294 (emphasis added).

[26] *Id.* at 679. Unless noted otherwise, the brief describes the properties of elements and compounds at standard temperature and pressure (roughly, room temperature at mean sea level).

[27] *Id.* at 996.

[28] *See United States v. New Castle County*, 769 F.Supp. 591, 596 (D. Del. 1991) (noting that no one would seriously propose regulating the compound water as a hazardous substance just because it contained the element hydrogen).

[29] *Science Explorer, Grade 7* (Prentice-Hall, Inc. 2002) 26. Excerpts of the textbook are in App. F.

There is no reason, therefore, to presume that a phosphate compound will exhibit the properties of elemental phosphorus. Elemental phosphorus burns and desiccates plants;[30] phosphate nourishes them. Waco has not shown that phosphates exhibit the toxic, explosive characteristics of elemental phosphorus. Indeed, Waco complains about phosphate's beneficial, nutritious effects on aquatic plants.[31]

2. Compounds are not mixtures.

"Mixture" is defined as: "A composition of two or more substances *that are not chemically combined with each other and are capable of being separated.*"[32] The textbook notes that "each substance in a mixture *has its own properties.*"[33] A mixture can be separated by physical means, like cream from milk. In contrast, a compound's constituent substances are chemically bound and cannot be separated by physical means.

EPA's definition of "mixture" used to designate hazardous substances excludes compounds:

> "Mixture" means any combination of two or more elements and/or compounds in solid, liquid, or gaseous form *except where such substances have undergone a chemical reaction so as to become inseparable by physical means.*[34]

While a mixture may have a compound as a constituent substance, a compound itself is not a "mixture," because a compound by definition is formed by a chemical bond that cannot be

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[30] ATSDR, *Toxicological Profile for White Phosphorus*, § 5.3.2.3.

[31] Third Amended Complaint ¶ 105 ("phosphorus [sic] . . . causes the growth of algae").

[32] *Am. Heritage Dict.* at 892 (emphasis added).

[33] *Sci. Explorer, Grade 7*, at 27.

[34] 43 FED. REG. 10,474, 10,480 (Mar. 13, 1978) (codified at 40 C.F.R. § 116.3) (emphasis added). A copy of the rule is in App. G.

separated by physical means. Thus, for purposes of designating hazardous substances under the Clean Water Act (and through it, CERCLA), a compound is not a mixture.[35]

Phosphate is a compound, not a mixture containing elemental phosphorus. Cow manure is a mixture containing phosphate, not a mixture containing elemental phosphorus. When the mixture cow manure is separated by physical means, the constituent substance is phosphate, not elemental phosphorus.

B. Congress and EPA intended the list of hazardous substances to include elemental phosphorus and specifically-named compounds of phosphorus, not all compounds of phosphorus.

As noted above, elemental phosphorus is a listed hazardous substance under CERCLA because it is listed as a hazardous substance under the Clean Water Act and as a hazardous air pollutant under the Clean Air Act. The legislative and regulatory histories of those listings (and the contemporaneous listing of "toxic pollutants" under the Clean Water Act) demonstrate that Congress and EPA intended to list phosphorus in its elemental form, and only those compounds of phosphorus that are specifically listed.

1. Under the Clean Water Act, EPA listed elemental phosphorus and some specific phosphorus compounds, but not all phosphorus compounds.

In the 1972 amendments of the Clean Water Act, Congress directed EPA to list "as hazardous substances . . . such *elements and compounds* which, when discharged in any

[35] *See New Castle County*, 769 F.Supp. at 596-97 (holding that a compound is not a mixture, so the plaintiff must show that the compound will decompose and release a listed hazardous substance under conditions normally present at the disposal site).

quantity into or upon the navigable waters of the United States . . . present an imminent and substantial danger to the public health or welfare."[36] EPA promulgated the listing in three steps: an advanced notice of proposed rulemaking, published in 1974;[37] a notice of proposed rulemaking, published in 1975;[38] and a notice of final rulemaking, published in 1978.[39] In all three publications, EPA listed the common name and synonyms of the hazardous substances. It listed "phosphorus" with the synonyms "black phosphorus, red phosphorus, white phosphorus, yellow phosphorus."[40] Each of these names refers to a different allotrope (*i.e.,* crystalline form) of the element phosphorus, not to compounds of phosphorus.[41]

EPA listed some specific compounds that contain phosphorus (such as phosgene and phosphoric acid).[42] EPA specifically deleted from its proposal other compounds of phosphorus (such as ferric glycerophosphate, ferric phosphate, phosphorus pentaflouride, and sodium phosphate (monobasic)) because they did not pose imminent threats to public health and welfare.[43] Selecting among compounds of phosphorus would have been pointless and irrational if EPA intended the listing "phosphorus" to sweep in all compounds of phosphorus.

Contemporaneous EPA rulemaking confirms that listing "phosphorus" did not include

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[36] 33 U.S.C. § 1321(b)(2)(A) (emphasis added); *see also* 39 FED. REG. 30,466 (Aug. 22, 1974).

[37] 39 FED. REG. 30,466-71 (Aug. 22, 1974). A copy of the advance notice is in App. H.

[38] 40 FED. REG. 59,960-76 (proposed Dec. 30, 1975) (to be codified at 40 C.F.R. §§ 116.1-.4 & Table 116.4). A copy of the proposed rule is in App. I.

[39] 43 FED. REG. 10,474-88 (Mar. 13, 1978) (codified at 40 C.F.R. §§ 116.1-.4 & Tables 116.4 A & B).

[40] 39 FED. REG. at 30,470; 40 FED. REG. at 59,975; 43 FED. REG. at 10,485.

[41] ATSDR, *Toxicological Profile for White Phosphorus*, § 3.2.

[42] 39 FED. REG. at 30,470; 40 FED. REG. at 59,975; 43 FED. REG. at 10,485-86.

[43] 40 FED. REG. at 59,965-96; 43 FED. REG. at 10,479.

all compounds of phosphorus, such as all phosphates. In the Clean Water Act amendments of 1972, Congress directed EPA to develop a list of toxic pollutants.[44] EPA listed "cadmium and *all* cadmium compounds, cyanide and *all* cyanide compounds, [and] mercury and *all* mercury compounds."[45] Thus, when EPA intended to include all compounds of an element, it said so explicitly.

Four years later, Congress adopted this vocabulary of explicitly using the term "compounds" when it intended to include on a list of hazardous substances all compounds of an element. After its initial rulemaking, EPA developed an expanded list of toxic pollutants to settle lawsuits filed by environmental groups dissatisfied with EPA's progress in the area.[46] Congress ratified the list[47] and directed EPA to publish it.[48] The published list included 13 entries of "[element] and compounds," such as "Mercury and compounds."[49]

Another set of rulemaking confirms that the listing of "phosphorus" did not include all compounds of phosphorus. When EPA referred to phosphate compounds generically, it

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[44] 33 U.S.C.A. § 1317(a) (West Supp. 1973).

[45] 38 FED. REG. 18,044 (proposed July 6, 1973) (emphasis added). A copy of the proposed listing is in App. J. 38 FED. REG. 24,342, 24,344 (Sept. 7, 1973). A copy of the initial final list is in App. K. The rulemakings to list hazardous substances and toxic pollutants should be read together because they were complementary parts of a coordinated regulatory strategy. 42 FED. REG. 10,474 ("The promulgation of this regulation [designation of hazardous substances] is a major component of the Environmental Protection Agency's strategy to regulate the discharge into the Nation's waters of toxic and hazardous substances.").

[46] John C. Dernbach, *The Unfocused Regulation of Toxic and Hazardous Pollutants*, 21 HARV. ENVTL. L. REV. 1, 32-33 (1997), hereinafter cited as "Dernbach, *Unfocused Regulation*." *See also Hercules, Inc. v. EPA*, 598 F.2d 91, 101 & n.14 (D.C. Cir. 1978).

[47] Dernbach, *Unfocused Regulation* at 33-34; 33 U.S.C. § 1317(a)(1).

[48] 33 U.S.C. § 1317(a)(1).

[49] 43 FED. REG. 4108, 4109 (Jan. 31, 1978) (codified, as later amended, at 40 C.F.R. § 401.15). A copy of the Federal Register listing is in App. L. Note that the list omits "phosphorus and compounds."

used the term "total phosphorus."[50] Shortly after EPA designated elemental phosphorus as a hazardous substance,[51] it proposed to designate total phosphorus (primarily phosphates) as a "conventional pollutant" under the Clean Water Act,[52] which would have subjected total phosphorus to *less stringent* regulation than non-conventional pollutants and *much less stringent* than toxic or hazardous pollutants.[53] EPA's proposal to relax regulation of phosphate directly refutes Waco's claim that in a contemporaneous rulemaking, EPA intended to include all phosphate compounds under more stringent regulation as hazardous substances. Ultimately, EPA decided to continue regulating total phosphorus in the middle tier of non-hazardous, non-toxic, non-conventional pollutants.[54]

Therefore, EPA's listing of "phosphorus" as a hazardous substance was not intended to include all compounds of phosphorus. Instead, EPA specifically listed the compounds of phosphorus it intended to designate as hazardous substances.

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[50] *See, e.g.*, 38 FED. REG. 28,758, 28,759 (Oct. 16, 1973) (codified at 40 C.F.R. § 136.1-.5 & Table I) (proposing test procedures for total phosphorus). A copy of the adopted rule is in App. M.

[51] 43 FED. REG. at 10,486.

[52] 43 FED. REG. 32,857 (proposed July 28, 1978). A copy is in App. N. Although the rule proposal generally uses the term "phosphorus," EPA specifically noted that in that rulemaking, "[p]hosphorus means total phosphorus as defined at 40 C.F.R. 136 [the test procedures for total phosphorus]," to distinguish it from elemental phosphorus. *Id.* at 32,858. That specific reference distinguishes these facts from *Massachusetts v. Blackstone Valley Elec. Co.*, 67 F.3d 981, 988-91 (1st Cir. 1995), where the appellate court held that EPA's test procedures could not help define the scope of the listing "cyanides," because the rules did not use the test to define the term. Here, EPA defined "total phosphorus" with respect to the test.

[53] 43 FED. REG. 32,857 ("Since BCT [best conventional pollution control technology, which applied to conventional pollutants] will always be equal to *or less stringent* than BAT [best available control technology economically achievable, which applied to non-conventional pollutants], BCT may be less protective of water quality." (Emphasis added.)).

[54] 44 FED. REG. 44,501 (July 30, 1979) (list of conventional pollutants codified at 40 C.F.R. § 401.16). A copy of the final rulemaking is in App. O.

2. In the Clean Air Act, Congress listed elemental phosphorus and some specific phosphorus compounds, but not all phosphorus compounds.

The Clean Air Act's list of hazardous air pollutants is the other source for phosphorus being a listed hazardous substance under CERCLA. While considering changes to the Act in the late 1980's, Congress and EPA developed a list of 189 hazardous air pollutants,[55] which Congress enacted into the law.[56] Congress listed "phosphorus" and some specific compounds of phosphorus (such as phosgene and phosphine). It also listed generically all the compounds of 12 elements, as "[Element] Compounds," but phosphorus is not among those elements. Congress even enacted a note explaining that it used "compounds" to designate all compounds of an element.[57] Thus, Congress did *not* intend the bare listing "phosphorus" to include all phosphorus compounds.

3. The conclusion is consistent with the case law.

The conclusion that Congress and EPA intended to list phosphorus in its elemental form — but not all compounds of phosphorus — is consistent with the case law.

In *United States v. Alcan Aluminum Corp.*,[58] *Arizona v. Motorola, Inc.*,[59] and *City of*

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[55] Dernbach, *Unfocused Regulation*, at 41.

[56] 42 U.S.C. § 7412(b)(1).

[57] *Id.* (note immediately following the last-listed hazardous air pollutant, "Selenium Compounds").

[58] 964 F.2d 252, 263 (3rd Cir. 1992) (compounds containing cadmium, chromium, copper, lead, or zinc are hazardous substances due to the generic listings under the Clean Water Act).

[59] 774 F.Supp. 566, 569, 572 (D. Ariz. 1991) (holding that a mixture containing compounds of arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc is a hazardous substance). Note: all those elements are listed as "[element] and compounds" in the list of hazardous substances. 40 C.F.R. § 302.4.

New York v. Exxon Corp.,[60] the courts held that listings of the form "[element] and compounds" designated all the compounds of the element as hazardous substances, even if the particular compound at issue was not specifically listed. Furthermore, in *Dana Corp. v. American Standard, Inc.*,[61] *United States v. New Castle County*,[62] and *United States v. Serafini*,[63] the courts held that if a compound is not listed as a hazardous substance (or covered by a generic listing), a mixture containing the compound does not contain a hazardous substance, and the defendant is not liable, unless the plaintiff proves that the compound will decompose and release a listed hazardous substance under the conditions normally present at the site.

Waco's bare assertion that cow manure is a hazardous substance is based entirely on manure containing phosphates — a *compound* of phosphorus. However, there is no generic listing of "phosphorus and compounds"; Waco has not shown that the phosphates in manure are listed hazardous substances under CERCLA; and Waco has not asserted (and could not show) that cow manure spontaneously releases elemental phosphorus under the conditions at Lake Waco. Therefore, according to the case law, Waco's claim fails.

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[60] 766 F.Supp. 177, 182-83 (S.D. N.Y. 1991) (holding that any compound containing cadmium, chromium, or lead is a hazardous substance because of the generic listings of "cadmium and compounds," "chromium and compounds," and "lead and compounds" under the Clean Water Act).

[61] 866 F.Supp. 1481, 1501 (N.D. Ind. 1994) (holding defendant not liable for waste that does not contain a listed hazardous substance unless the plaintiff shows the waste would release a listed hazardous substance under the normal conditions of the landfill).

[62] 769 F.Supp. 591, 597-98 (D. Del. 1991) (holding that polyvinyl chloride is not a listed hazardous substance and there is no showing it would release the listed hazardous substance vinyl chloride).

[63] 750 F.Supp. 168, 171 (M.D. Pa. 1990) (defendant not liable because there was no showing the polyvinyl chloride, which is not a listed hazardous substance, would release the listed hazardous substances benzene or hydrogen chloride under the normal conditions at the landfill).

II. Alternatively, the Court should defer to EPA's scientific and regulatory judgment.

As shown above, basic science, the legislative and regulatory histories, and case law establish as a matter of law that both Congress and EPA intended the listing "phosphorus" (and the synonyms "black phosphorus, red phosphorus, white phosphorus, yellow phosphorus") to designate phosphorus in its elemental form, not all compounds of phosphorus and especially not the phosphates naturally present in manure. However, if there is doubt, the Court should refer the determination to EPA.

In *Massachusetts v. Blackstone Valley Electric Co.*, the First Circuit referred to EPA the determination of whether ferric ferrocyanide was included under the Clean Water Act's listing of "cyanides" as a toxic pollutant and, therefore, as a CERCLA hazardous substance.[64] The court held that the listing "cyanides" was ambiguous, in part, because EPA originally listed "cyanide and all cyanide compounds,"[65] but the list adopted by Congress substituted "cyanides."[66] Faced with dueling experts, the appellate court invoked the doctrine of primary jurisdiction, noting that "Congress delegated to the EPA, not to the courts, the authority to administer the CWA toxic pollutant list and the CERCLA list of hazardous substances."[67] The court determined that EPA's determination of such matters lies at the heart of the tasks

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[64] 67 F.3d 981 (1st Cir. 1995).

[65] 38 FED. REG. 24,344.

[66] 67 F.3d at 987-88.

[67] *Id.* at 992. The D.C. Circuit reached a similar conclusion when it upheld EPA's listing of PCBs as toxic pollutants. *Envtl. Defense Fund v. EPA*, 598 F.2d 62, 83-84 (D.C. Cir. 1978) ("EPA, not the court, has the technical expertise to decide what inferences may be drawn from characteristics of related substances and to formulate policy with respect to what risks are acceptable.").

assigned it by Congress, EPA's expertise could unravel technical facts, and EPA's determination would aid the court. Moreover, referral would promote national uniformity.[68]

If the Court believes that the listing of black, red, white, and yellow phosphorus may include more than just elemental phosphorus, and if the Court accepts dueling evidence contending whether cow manure is a hazardous substance, then the holding in *Blackstone Valley Electric Co.* deserves to be followed, and the Court should refer the matter to EPA.

National uniformity is especially important in this case because an obligation to manage animal wastes as hazardous substances or hazardous wastes would impose significant costs on the state's agricultural community, putting it at a competitive disadvantage with other exporting states. Furthermore, a decision to characterize animal waste as a "hazardous substance" would have important ramifications for other regulatory programs, such as management of municipal sewage sludge, composting and recycling programs, and state and EPA cost-recovery actions. As the First Circuit noted, Congress assigned such policy-balancing tasks to EPA, not the courts.[69]

CONCLUSION

The common meaning and history of the statutes and regulations pertinent to designating hazardous substances demonstrate as a matter of law that Congress and EPA listed elemental phosphorous — not all compounds of phosphorus — as a hazardous substance. Animal waste is a mixture containing unlisted phosphates, not a mixture

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[68] *Blackstone Valley Elec. Co.*, 67 F.3d. at 992.

[69] *Id.* (within the authority delegated to EPA to properly weigh all the competing arguments).

containing elemental phosphorus.

A final determination that phosphates are hazardous substances under CERCLA merely because they are compounds of phosphorus would have unreasonable consequences. If animal waste must be managed as a hazardous substance, then so must municipal sewage. The interlocutory orders will limit options and raise costs for farmers and cities without a commensurate environmental benefit.

Most members of the agricultural community manage animal waste properly. Some do not. Designating animal waste as a hazardous substance is an erroneous and costly way to force the few to do what the majority already do.

Therefore, the Court should reconsider and reverse its holding that cow manure is a hazardous substance.

Respectfully submitted,

GREG ABBOTT
Attorney General of Texas

BARRY R. McBEE
First Assistant Attorney General

EDWARD D. BURBACH
Deputy Attorney General for Litigation

KAREN W. KORNELL
Assistant Attorney General
Chief, Natural Resources Division

ANTHONY GRIGSBY
Assistant Attorney General
State Bar No. 08491500

Natural Resources Division (MC-015)
P.O. Box 12548
Austin, Texas 78711-2548
Vox: (512) 463-2012
Fax: (512) 320-0052

ATTORNEYS FOR AMICUS CURIAE,
TEXAS DEPARTMENT OF AGRICULTURE

CERTIFICATE OF SERVICE

I certify that a true and correct copy of the foregoing document was served on the persons listed below by the method identified below on this 13th day of October, 2005.

Anthony Grigsby

By certified mail, return receipt requested:

Roy Lee Barrett
Kerry Haliburton
Enid A. Wade
Naman, Howell, Smith & Lee, L.L.P.
900 Washington, 7th Floor
P.O. Box 1470
Waco, Texas 76703-1470
Counsel for Plaintiff City of Waco

James D. Bradbury
Dan Reed
Jackson Walker, L.L.P.
301 Commerce Street, Suite 2400
Fort Worth, Texas 76102
Counsel for Harold Wayne Parks, Parks Hill Dairy, Tony Beltman, Scenic Ridge Dairy, Paul Van Leeuwen, Andy Van Die, and Triple Dutch Dairy

George T. Shipley
Tynan Buthod
J. Scott Janoe
Baker Botts
One Shell Plaza
910 Louisiana
Houston, Texas 77002
Counsel for Aztex Dairy, Inc., Fred R. Lueck, Sr., and Judy A. Lueck

By certified mail, return receipt requested:

Don Martinson
Alan Moore
Fanning, Harper & Martinson, P.C.
Two Energy Square
4849 Greenville Avenue, Suite 1300
Dallas, Texas 75206
Counsel for Defendants Hidden View Dairy, William N. De Jong, and William C. De Jong

Russell W. King
King Law Offices, P.C.
1523 Lingleville Road, Suite B
Stephenville, Texas 76401
Counsel for Defendants Schouten Dairy, Dennis Schouten, Cornelius T. Schouten, Nicholas Schouten, Joan Schoten, Nancy Schouten, and Linda Schouten

Raymond White
Ryan T. Shelton
Akin Gump Strauss Hauer & Feld, L.L.P.
300 West Sixth Street, Suite 2100
Austin, Texas 78701
Counsel for S Cow 10 Dairy, Tex-S, L.L.C., Bill Schouten, Pete Schouten, M.D. Schouten, and Golden Star Dairy, Robert J. Schouten, Pete Henry Schouten, and Pieter Bakker

By Interagency Mail:
(Courtesy Copy)

Ellen Witt
General Counsel
Texas Department of Agriculture
P. O. Box 12847, Capitol Station
Austin, Texas 78711-2847

Frequently Asked Questions

Q: Will certifying my dairy increase my exposure to enforcement? *No, it will reduce your exposure. CDQAP allows producers to identify any potential violations and correct them, before enforcement action occurs.*

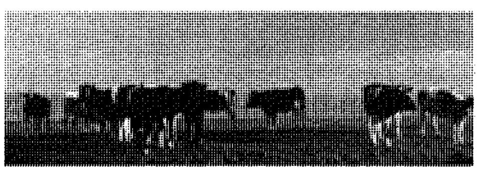
Q: What happens to my certification records? *Information generated during an independent, third-party evaluation remains on the dairy and cannot be used as the basis of an official enforcement action.*

Q: How much does the program cost? *Nothing. Dairy producers may attend the six-hour Environmental Stewardship Short Course free of charge. After completing coursework, producers are eligible for a free, on-site evaluation by a third-party evaluator.*

Q: What if my dairy isn't certified after being evaluated? *If the evaluator identifies areas of the dairy that need improvement, the producer can correct them and reschedule an additional free on-site evaluation at a later date.*

Q: How does CDQAP help regulators? *CDQAP increases compliance through education. Dairies operate under complex state, federal and local laws and regulations. Knowing all the rules—let alone complying with them—is a challenge. With classroom education and on-site evaluation, CDQAP provides a fast, simple and efficient way for the dairy producer to understand his or her obligations, and how to meet them. This means fewer dairies out of compliance, allowing regulators to better focus their limited enforcement resources.*

Q: Is participation in CDQAP required? *Participation in CDQAP is completely voluntary. However, producers who choose to certify their dairies may enjoy several benefits, including reduced water quality permitting fees and peace of mind associated with knowing the operation is in compliance.*



Program Benefits

CDQAP benefits communities, regulatory agencies and the dairy industry.

Dairy Producers:

- Greater confidence and peace of mind for producers that their facilities are in compliance
- Improved nutrient management
- Enhanced neighbor and community relations
- Lowered risk of potential fines from violations
- Reduced permit fees and streamlined reporting
- Takes guesswork out of compliance, resulting in savings of time and money

Community:

- Peace of mind for neighbors of dairies
- Public confidence that local dairies are complying with public health and environmental safety requirements
- Improved opportunities for sustainable growth, jobs and employment

Regulatory:

- Increased producer cooperation and dedication to compliance and environmental stewardship
- Enhanced efficiency of regulators in the field
- Improved allocation of regulatory resources

CDQAP Partners

California Environmental Protection Agency • California Department of Food and Agriculture
The California Resources Agency • U.S. Environmental Protection Agency
State Water Resources Control Board • California Department of Fish and Game
U.S. Department of Agriculture • University of California
California Manufacturing Milk Advisory Board • California Farm Bureau Federation
Western United Dairymen • Milk Producers Council

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or

More Questions? Visit www.CDQA.org or call
CDQAP Information Center at 1-866-66CDQAP (1-866-662-3727)

Environmental Stewardship Module

CALIFORNIA DAIRY
Quality Assurance
PROGRAM

Compliance Through Education

"It's truly a remarkable, world-class program in helping industry protect the environment."

A.G. Kawamura, Secretary
California Department of Food and Agriculture

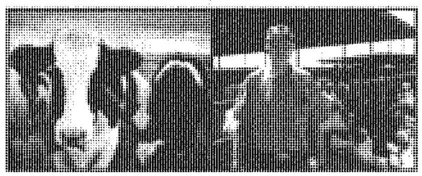
About CDQAP

The California Dairy Quality Assurance Program (CDQAP) is a partnership of government, educators and the dairy industry, working together toward a single, shared goal: helping California dairy producers understand and comply with federal, state and local laws and regulations.

The voluntary program provides education, resources and funding for the certification of dairy producers in the following areas:

- **Environmental Stewardship**
- **Johne's Disease**
- **Food Safety and Emergency Preparedness** *(under development)*
- **Animal Welfare** *(under development)*

This brochure focuses on the Environmental Stewardship module of CDQAP. Certification for this component is done in two basic steps:



Education: CDQAP provides a six-hour Environmental Stewardship Short Course for dairy producers. This covers the various environmental laws and what they mean for dairies.

Certification: Once a producer has completed the course, he or she is then eligible for certification. Evaluations–which include dairy records and facilities–are conducted at no cost to the dairy producer, thanks to government and industry funding. Third-party evaluators visit dairies to ensure they are in compliance with all laws. Evaluators are independent of both the producer and environmental regulators.

CALIFORNIA DAIRY Quality Assurance PROGRAM

Dairy Producers Talk About CDQAP

Joe Silva, ***Los Banos***—*"I was apprehensive at first about inviting a CDQAP evaluator to my dairy. But I decided it would be better to be proactive than reactive. I reviewed the notes from my CDQAP class, and filled out a simple checklist. I identified a couple of things I needed to do, and took care of them. Then I set up an appointment for a CDQAP evaluation.* ***Thanks to the classroom prep I knew exactly what to expect and the evaluation went smoothly."***

John Draxler, ***Hanford***—*"After taking the class, I decided to seek certification. After the free evaluation, I found out I needed to address a couple of issues on my dairy if I wanted to be certified.* ***I was able to fit the repairs into my schedule and at my own pace, without worrying about a fine or deadline.*** *Then I scheduled a second evaluation—also free—and now my dairy is certified."*

Bill Hoekstra, ***Oakdale***—*"Even before CDQAP was formed, our dairy invested in more lagoon capacity and better water management. We wanted to do the right thing—and getting certified through the third-party evaluation was a way of earning recognition for the work we'd done. We also were able to identify a few other minor alterations that needed to be worked on.* ***The solutions were surprisingly practical and straightforward. We saved money by knowing what really needed to be fixed, and what was fine.*** *Now we're really confident that our dairy is in compliance. The investment has paid for itself in peace of mind."*

Sharon Doughty, ***Point Reyes Station***—*"Sometimes it's helpful to have fresh eyes look at your operation. The third-party evaluation of the CDQAP was very useful to us.* ***The regulatory agencies in our area respect the fact that we have participated in the CDQAP.*** *They seem to have a greater appreciation and trust for our stewardship efforts since we became certified."*

Stepping Up to Certification

The California Dairy Quality Assurance Program offers powerful classroom instruction on environmental regulations and dairy waste management. But taking the classes is just the first step.

Dairy certification means going from learning to doing, from theory in the classroom to practical application on the dairy. Each certified producer develops a plan for environmental compliance specific to his or her dairy, covering issues from proper drainage and plumbing to proper manure storage and emergency plans. An independent third-party evaluator checks the plan, then evaluates the operation to ensure that it is in compliance with federal, state and local environmental laws. If adjustments are needed, the producer can schedule repairs and a second evaluation, also free of charge.

For producers who have been considering certification, the time is now. New federal and state regulations for animal feeding operations have led to growing scrutiny of dairies. Certification assures regulators that you are able to understand and comply with regulations.

Additionally, awareness and recognition of the CDQAP as one of the nation's leading environmental stewardship programs is growing rapidly. California regulators are now offering reduced water quality permitting fees to CDQAP-certified dairies, and other incentives such as reduced paperwork are being aggressively pursued. Additional help and support may be available through your dairy trade association, cooperative, processor or University of California Cooperative Extension offices.

Interested in Certification? Call the CDQAP Information Center at 1-866-66CDQAP (1-866-662-3727)

[illegible]

THE UNITED STATES CONFERENCE OF MAYORS

1620 EYE STREET, NORTHWEST
WASHINGTON, D.C. 20006
TELEPHONE (202) 293-7330
FAX (202) 293-2352
URL: www.usmayors.org

September 4, 2007

The Honorable Barbara Boxer
Chair, Environment and Public Works Committee
United States Senate
Washington, DC 20510

Dear Madam Chairwoman:

The U.S. Conference of Mayors is writing to express our opposition to amending the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) to provide that animal manure waste not be considered a hazardous substance or pollutant/contaminant under the Act.

The Conference of Mayors, primarily through its Mayors' Water Council, has advocated since 1997 for the development of a flexible national program for the sustainable management of watersheds and their resources. We maintain that the protection, preservation and enhancement of water resources is critical to the continued revitalization of the nation's cities and that clean water is necessary to maintain the quality of life in cities, supporting recreational, historical, cultural and economic development activities across the country. Exempting mismanaged animal manure wastes from environmental responsibility is contrary to the interests of our cities and the public health and economic impact on our citizens.

The U.S. Conference of Mayors calls upon Congress, as well as Governors, state legislatures, and federal and state regulatory authorities to aggressively take action to protect the nation's water supplies from further degradation due to non-point agricultural sources. We have called for the establishment of policies that are flexible in protecting water supplies. We have been early and strong supporters of water quality trading approaches that would allow less costly solutions for large animal feedlot operations and dairy and livestock farms to come into, or stay in, compliance with requirements designed to protect surface and ground water resources from contamination by phosphorous and nitrogen contaminants constituents of animal manures.

The cost to cities to comply with water and CERCLA related unfunded federal mandates has been exceptionally high over the last three decades. The current situation with animal wastes impairing city water supplies has added to those costs unfairly. Regulatory enforcement of agricultural non-point sources has not been aggressively applied as it has for cities. The Conference of Mayors values the economic and nutritional contributions that animal farmers make to this nation and its citizens, but we should not and cannot overlook the fact that many large dairy operations externalize the costs to control nutrient impacts that impair our municipal drinking water supplies and degrades the water quality of our estuaries, lakes and rivers. We urge Congress to adopt federal policies that address the impacts on ground waters and surface waters, and associated threats to drinking water supplies from urban, suburban, rural, agricultural and other activities in an equitable manner ensuring that all sectors of society are proportionately responsible and equally accountable for maintaining and improving the quality of the nation's waters.

The proposal to exempt animal manure that is mismanaged and pollutes community water resources from CERCLA is contrary to the interests of our nation's cities and should not be adopted. Animal wastes that are properly managed and/or land applied according to good management practices should never become a pollutant or contaminant. We urge you to help protect our cities, citizens and water resources.

If you have any questions, please contact Judy Sheahan of my staff at 202-861-6775. Thank you for your consideration.

Sincerely,

Tom Cochran

Tom Cochran
Executive Director

CERCLA allows governmental bodies to recover the costs of cleaning up releases of hazardous substances and to recover damages for injuries to natural resources caused by such releases. EPCRA requires those responsible for unpermited releases of pollutants (such as spills) to report such releases to state and local officials. Both laws already exempt traditional agricultural practices, such as the normal application of local manure as fertilizer. In addition to exempting manure from the reach of CERCLA and EPCRA, H.R. 4341 defines manure to include anything in or commingled with animal waste, no matter how harmful. Thus, the proposed legislation would take from the states the ability to recover costs or damages in federal court from manure spills that, although rare, unfortunately can have broad and devastating effects.

The overwhelming majority of agricultural operations comply with existing law and need no broad exemption for manure. The elimination of CERCLA and EPCRA as potential enforcement tools in this area would be a serious mistake. Therefore, I respectfully urge you to resist any effort to that would accomplish such an unwise objective.

Sincerely,

ELIOT SPITZER
Attorney General

cc: Subcommittee Members

STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL
120 BROADWAY
NEW YORK, NY 10271

ELIOT SPITZER
Attorney General

(212) 416-8050

June 26, 2006

Honorable Conrad Burns
Chairman
Interior and Related Agencies Subcommittee
Senate Committe on Appropriations
United States Senate
SD-187 Dirksen Senate Office Building
Washington, DC 20510

Honorable Byron L. Dorgan
Ranking Member
Interior and Related Agencies Subcommittee
Senate Committe on Appropriations
United States Senate
SH-322 Hart Senate Office Building
Washington, DC 20510

Re: Environmental exemptions for animal feeding operations
H.R. 4341 and Senate appropriations language

Dear Senators Burns and Dorgan:

I am writing to express my concern about H.R. 4341 or any similar legislation in the Senate that would carve major loopholes into two of our nation's most important environmental laws. By excluding manure from the definition of "hazardous substances" in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as Superfund) and the definition of "pollutant" in the Emergency Planning and Community Right-to-Know Act (EPCRA), H.R. 4341 threatens to compromise the public's need for effective environmental protection.

Both CERCLA and EPCRA are critical to protecting public health and the environment, especially drinking water supplies, and have withstood the test of time. A new, sweeping exemption for manure would set a dangerous precedent of eroding vital legislation of general application.

To strengthen and promote cities as centers of opportunity, leadership, and governance.

National League of Cities

1301 Pennsylvania Ave., N.W.
Washington, D.C. 20004-1763
202-626-3000
Fax: 202-626-3043
www.nlc.org

June 29, 2006

Dear Member of Congress:

I am writing on behalf of the National League of Cities to express our concern over a proposal that would preclude local governments from recovering the costs of removing or reducing high levels of contaminants, such as phosphorus, from non-point agricultural sources and urge you to oppose amending the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) to provide that animal manure waste not be considered a hazardous substance or pollutant/contaminant under the Act.

The cost to cities to comply with water and CERCLA-related unfunded federal mandates has been exceptionally high over the last three decades. The current situation with animal wastes impairing city water supplies has added to those costs unfairly. Regulatory enforcement of agricultural non-point sources has not been as aggressively applied as it has for cities.

The proposal to exempt animal manure that is mismanaged and pollutes community water resources from CERCLA is contrary to the interests of our nation's cities and should not be adopted. Animal wastes that are properly managed and/or land applied according to good management practices should never become a pollutant or contaminant. We urge you to help protect our cities, citizens and water resources by opposing this proposal.

If you have any questions, please feel free to call Leslie Wollack, Principal Legislative Counsel at 202-626-3029.

Sincerely,

Donald J. Borut

Donald J. Borut
Executive Director

NACO National Association of Counties
Counties Care for America

June 26, 2006

Dear Member of Congress:

On behalf of the National Association of Counties (NACo), I am writing about a proposal to remove animal manure waste as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

Many counties across the nation have been involved in controversies surrounding these large concentrated animal feeding operations (CAFOs). While CAFOs may bring economic benefit to a region, they also have the potential to present environmental and public health threats. Animal waste, if not properly managed, can cause serious environmental damage such as oxygen depletion of surface water, pathogens, nutrient contamination of surface and ground water, unsafe air emissions and nuisance odors. Public health has been threatened through contamination of drinking water, fish kills, shellfish contamination and swimming advisories.

NACo believes that the availability of an adequate supply of clean water is vital to our nation. At the same time, we recognize that the elimination of water pollution is a long-term process that is limited by economic and social costs. Rural communities are largely dependent on CAFOs, for they bolster local economies. On the other hand, technologies and best practices exist for CAFOs that can lessen their environmental and public health footprints on the community.

In addition to environmental and public health threats, clean-up of polluted waterways from CAFOs have the potential to be a huge unfunded federal mandate, mainly by passing on the costs of remediation to our counties who had little to do with the pollution in the first place. To that end, we encourage you to oppose removing animal manure waste as a pollutant/contaminate under CERCLA.

If you have any questions, feel free to contact Julie Ufner on my staff at 202-942-4269. Thank you for your consideration.

Sincerely,

Larry E. Naake

Larry E. Naake
Executive Director

Kathy Taylor
MAYOR
•
918 • 596 • 7411

CITY OF TULSA OKLAHOMA

OFFICE OF THE MAYOR

200 CIVIC CENTER • TULSA, OKLAHOMA • 74103

June 2, 2005

Dear Members of the House and Senate:

As the Mayor of Tulsa, Oklahoma I am writing to express my deep concerns about a proposal that could preclude community drinking water providers, such as the Tulsa Metropolitan Utilities Authority, from recovering the costs of removing or reducing high levels of contaminants, such as phosphorus, from large upstream animal feeding operations.

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) is the only federal statute that allows municipal governments and drinking water utilities to recover cleanup or water treatment costs from parties responsible for contamination of local drinking water supplies with hazardous substances. By exempting from regulation the application of animal manure at rates above the needs of crops, the proposal would preclude local communities from recovering the monies that they are being forced to spend to deal with the problem.

Nonpoint source pollution of drinking water supplies is a significant problem both in Oklahoma and elsewhere, and communities have been burdened with the high cost of treating the polluted water. In the case of my own city, residents have had to absorb substantial amounts of money through their rates for the purpose of treating water contaminated by large-scale poultry operations. Changing the CERCLA definition of a hazardous substance would also preclude federal or state cleanup efforts, forcing the treatment burden – and thus the treatment cost – onto community water systems and local consumers.

Progress is being today made on cleaning up Tulsa's water supply because we were able to use CERCLA to make those responsible for contamination take steps to solve the problem. Other communities deserve the same opportunity.

I strongly urge you to withhold your support for amendments to CERCLA regarding animal waste.

Sincerely,

Kathy Taylor
Mayor

CITY OF WACO

City Manager's Office
Post Office Box 2570
Waco, Texas 76702-2570
254 / 750-5640
Fax: 254 / 750-5880
www.waco-texas.com

June 2, 2006

The Honorable James M. Inhofe
Chairman
Senate Committee on Environment
and Public Works
410 Dirksen
Washington, D.C. 20510

The Honorable James M. Jeffords
Ranking Member
Senate Committee on Environment
and Public Works
410 Dirksen
Washington, D.C. 20510

Re: City of Waco Litigation Against Upstream Dairy CAFOs

Dear Senators Inhofe and Jeffords:

I am City Manager for the City of Waco, Texas, and have served in that position for four years. I was born and raised in Waco and am a life long resident of this community.

As you may know, after years of attempting to resolve water quality issues in Lake Waco by meeting and negotiating with dairy operators in the watershed and dairy industry representatives, the City of Waco was unable to achieve any meaningful solution to the problem. In fact, the City was unable to get any of the dairies to even admit they were contributing to the problem, despite the fact that every known public or private study that has examined these issues has concluded that the dairies are the most significant cause of the overloading of phosphorus into Lake Waco.

As a result of the dairies unwillingness to resolve these issues, the City of Waco sent out letters to sixteen different dairies in the watershed notifying those dairies that a suit would be filed by the City against those dairies unless those dairies contacted the City within 60 days and sought to resolve the issue. Only one dairy responded to this letter, and the City has worked with that dairy to resolve the issues and has not sued that dairy. Another dairy, without the knowledge of the City, filed for bankruptcy protection before the notice letter was sent. The City has not sued that dairy. The City is aware of no claim that this bankruptcy filing was due to any activities of the City.

After these extensive efforts to resolve these issues failed to result in any meaningful agreements to improve water quality, the City of Waco brought suit against fourteen large industrial dairies in the watershed, based on TCEQ records demonstrating very poor regulatory compliance at those dairies. The lawsuit was brought under both the Federal Clean Water Act the Federal Superfund statute (CERCLA). The City's lawsuit was highly effective. The City settled with eight of the fourteen original dairy defendants before the lawsuit was finally resolved in January 2006 by mediation. Under the eight pre-mediation settlements, the dairies have agreed to certain changes in their management practices, which allow them to continue agricultural operations and at the same time protect the river and the lake. The remaining six dairies settled with the City in January 2006 after court-ordered mediation. The final six settlements resolved the entire lawsuit.

None of the dairies that have settled with the City of Waco have paid money to settle the lawsuit. In one case, an insurance company for one of the dairies paid a cash settlement on behalf of that dairy, practically all of which the City then returned to the dairy operator in exchange for a conservation easement prohibiting the over polluted land on that dairy from ever again being used as a CAFO, but allowing it to be used for other agricultural purposes.

To the knowledge of the City of Waco, none of the fourteen dairies it sued have filed for bankruptcy protection or even threatened to file. The settlements ultimately reached with all fourteen dairies are consistent with the protections sought from the dairies when the City originally sent notices of its intent to sue. In fact, the one dairy that responded to the City's notice letter is currently negotiating with the City for a settlement on similar terms. It is the City's understanding that the dairy industry actually discouraged the fourteen dairies from responding to the City within the 60-day notice period and attempting to resolve the issues. This lack of response led to the filing of the lawsuit.

The final six settlements that were concluded by a Settlement Agreement filed January 11, 2006, are consistent with the earlier settlements. The only significant difference is the provision for a two-year sampling period during which the water quality in the North Bosque River will be tested during high flow events to determine if an agreed level of improvement in concentrations of phosphorus is achieved. If the improvement is achieved after the sampling period, the dairies would not be required to comply with any additional restrictions, including additional restrictions related to removal of solid manure, reduction in phosphorus diet, and land application of wastewater. If the water quality improvements are not achieved, each of the six dairies will have to comply with the additional restrictions. However, these additional restrictions are consistent with the earlier settlements and consistent with the requirements the City has sought all along.

It has never been the City of Waco's intent to put the dairies it sued or any other dairies out of business, and the City's lawsuit has not put any dairy out of business. The dairies claim that they were implementing a number of the City's requested changes in management practices even before the settlements.

It is critically important to the City of Waco to protect its public drinking water supply and the City had no choice but to undertake efforts to deal with the single most significant cause of taste and odor problems in Lake Waco--phosphorus released from dairy cow waste. The City of Waco is spending more than $54 million for capital improvements specifically to deal with taste and odor problems caused by excessive phosphorus released from dairy cow waste. Because some of the dairy operators in our watershed elect to over-apply waste to land and otherwise fail to properly manage waste, our citizens are burdened with significantly increased water rates.

The City of Waco remains opposed to any amendment to CERCLA that would exclude manure from the definition of hazardous substance.

Thank you for your time and attention to this important issue and feel free to contact me if you have any questions or desire any additional information.

Sincerely yours,

CITY OF WACO, TEXAS

By:

Larry D. Groth, P.E.
City Manager

mp

Cc: The Honorable Kay Bailey Hutchison
The Honorable John Cornyn
The Honorable Chet Edwards

Hidden View Dairy

1684 P.R. 1401 Dublin, TX 76446- (254)445-3272- FAX (254)445-3668- dejong@our-town.com

June 29, 2006

Hon. James M. Inhofe, Chairman
Senate Committee on Environment
410 Dirksen
Washington, D.C. 20510

Hon. James M. Jeffords, Ranking Member
Senate Committee on Environment
410 Dirksen
Washington, D.C. 20510

Re: Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA" or "Superfund") Applicability to Agricultural Operations

Dear Senators Inhofe and Jeffords:

My father and I manage a 2,000 head dairy farm in Erath County, Texas, which our partnership acquired in 1994. Since that time, we have consistently and substantially upgraded the animal and waste handling facilities at great expense. We have also implemented a series of innovative and environmentally protective practices at our dairy, which is generally recognized as one of the leading farms in Erath County. Other than our overzealous construction of a storm water control basin in 2001 (*i.e.*, environmentally protective, but not preauthorized), our dairy has not been the subject of any federal or state regulatory enforcement action. My family resides on this farm, and we are unquestionably committed to doing the right thing. We are very proud of our accomplishments and openly welcome visitors and dialogue about our operations.

All of this having been said, my father and I were personally and individually sued by the City of Waco in 2004 under the federal Superfund statute. We were subjected to nearly two years of bitter, humiliating and expensive federal litigation. Do we operate a large industrial dairy? No. Do we demonstrate very poor regulatory compliance? No. Do we exhibit an unwillingness to resolve issues? No. Yet, these are the very reasons being cited by critics of your Committee's consideration of statutory amendments to curb abuses of CERCLA.

Hon. James Inhofe
Hon. James Jeffords
June 21, 2006

From what I understand, the Superfund statute was originally intended to address the cleanup of abandoned industrial facilities outside the ordinary reach of existing regulatory programs. However, because of the allure of 'joint and several' liability and the broad classes of persons potentially liable under CERCLA, plaintiffs through their lawyers are trying to pound square pegs into round holes. Our nation's agricultural producers are the latest targets. In our particular case, the City of Waco was alleging that the naturally-occurring orthophosphate compound found in cow manure is the hazardous substance 'phosphorus' as listed under CERCLA; and that because some quantity of 'phosphorus' must have left our farm and contributed to some algae growth downstream, my father and I were somehow potentially liable for 100% of Waco's past and future costs of improving the aesthetic quality (taste and odor) of the city's drinking water – this, despite Waco's own releases of 'phosphorus' in the watershed and the responsibility of numerous other municipal, industrial and commercial entities not named in the suit. We eventually settled our case, but any suggestion that this was an appropriate use of our federal court system or sound public policy is severely misplaced, particularly in its application to my family and our dairy farm.

The U.S. Environmental Protection Agency and the Texas Commission on Environmental Quality – under the federal Clean Water Act and the Texas Water Quality Control Act – have more than ample permitting and enforcement authority to address any issue associated with our dairy farm. In fact, the State of Texas has promulgated some of the most stringent design, operating and permitting requirements in the nation for dairies. The dairy operations are routinely and thoroughly inspected. Statutory citizen suits are also available to potentially affected persons under the Clean Water Act, with the potential of recovering attorneys' fees and costs of litigation. Under these circumstances, it is not necessary or reasonable to extend CERCLA's draconian liability scheme to agricultural producers like Hidden View Dairy.

Congress should give very strong consideration to protecting agricultural producers from these grossly inequitable law suits under the Superfund statute. Please do not hesitate to contact me should you desire any further information or wish to tour our dairy farm.

Respectfully yours,

William N. De Jong

William N. De Jong

Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
JEFFREY R. VONK, DIRECTOR

June 7, 2006

The Honorable Tom Harkin
731 Hart Senate Office Building
Washington, DC 20510

Dear Senator Harkin:

The Iowa Department of Natural Resources opposes Senator Craig's amendment which seeks to exempt livestock operations from certain federal regulations.

While animal agriculture is subject to a number of permitting requirements, there continue to be concerns related to phosphorous and nitrogen runoff into our surface and groundwater. Iowa has more than 800 large earthen manure basins that have been in place for a number of years. A number of those predate the passage of many of the requirements that current operations must follow. Many Iowa streams and lakes are impaired by nutrients and are included on the EPA impaired waters list. Exempting livestock operations from CERCLA oversight removes an important tool to the state in its long term efforts to manage runoff or infiltration from these sites, particularly regarding potential cleanup.

EPCRA establishes requirements for reporting storage and release of hazardous and toxic chemicals. This information is reported to EPA so that they can watch for trends and changes in industries where emissions of these pollutants may be increasing and causing an increased risk to the public. There are minimum reporting thresholds that prevent those with truly low emissions from having to report. It is critical that any source of these emissions (over the thresholds) report such so that if limits need to be set, they are done before dangerous amounts of emissions cause serious threats to public health. It is the emissions that count, not who is emitting them that matters.

Senator Craig acknowledges EPA's recognition of the lack of current information related to animal agriculture. The current study on emissions from agricultural facilities through a consent agreement with many agricultural producers (where temporary relief from reporting is already provided) will help to provide the information necessary to determine whether these sources fall below the minimum reporting requirements. The study will also include information as to what size facilities may be expected to exceed those thresholds, and where further evaluation of public health risk should be conducted.

The Department of Natural Resources believes that it is important that time be allowed for the current air quality study to be completed so that enough information is available to determine the risks associated with emissions from animal feeding operations. If the emissions are determined to be below the minimum, then the requirements of EPCRA would not be applicable in any case.

Sincerely,

Jeffrey R. Vonk
Director

WALLACE STATE OFFICE BUILDING / 502 EAST 9th STREET / DES MOINES, IOWA 50319
515-281-5918 TDD 515-242-5967 FAX 515-281-6794 www.state.ia.us/dnr

STATE ATTORNEYS GENERAL

A Communication from the Chief Legal Officers
Of the Following States:

California - Connecticut - Kentucky - New Jersey - New Mexico - Oklahoma - Wisconsin

June 27, 2006

Dear Members of Congress:

We, the undersigned Attorneys General, write to express our concern with proposed legislation, H.R. 4341, that would exempt industrial-scale animal feeding operations from important provisions of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") and the Emergency Planning and Community Right-to-Know Act ("EPCRA"). As the chief legal officers of our states, we think that the proposed amendments, if enacted, would seriously impair our ability to protect the health of our citizens and the environment. Accordingly, we urge you to oppose these proposed amendments to CERCLA and EPCRA.

H.R. 4341 would exempt industrial-scale animal feeding operations from the provisions of CERCLA that require releases of hazardous substances to be reported to the government and the provisions that, among other things, authorize states to recover the costs of responding to releases of hazardous substances and the resulting damages to natural resources. It would also exempt animal feeding operations from the provisions of section 11004(a) of EPCRA that require reporting of the release of hazardous and extremely hazardous substances to the government. These exemptions would apply not only to the animal waste generated at animal feeding operations, but also to anything commingled with that waste, any process water, or any other substance in or emitted by the waste.

The exemption of animal feeding operations from CERCLA and EPCRA would severely constrain the ability of the states and the Environmental Protection Agency ("EPA") to require the investigation and cleanup of natural resources polluted by the improper disposal of industrial agricultural waste across the country. As of 2003, EPA estimated that animal feeding operations in the United States generated approximately 500 million tons of waste each year, three times more raw waste than is generated yearly by all the humans in the United States. 68 Fed. Reg. 7176-01, 7179-7180 (2003). The EPA reports that the primary pollutants commonly associated with animal waste that can be released into the environment include phosphorus, nitrogen, ammonia, pathogens, pesticides, antibiotics, hormones and metals, such as arsenic, copper, selenium, zinc, cadmium, molybdenum, nickel, lead, iron, manganese, aluminum, and boron. 66 Fed. Reg. 2960-01, 2976, 2978 (2001); 68 Fed. Reg. at 7181. The poultry industry alone is estimated to release approximately two million pounds of arsenic into the environment each year in the United States. See *Testimony of Robert S. Lawrence,* *MD, Johns Hopkins Bloomberg School of Public Health, before the House Subcommittee on Environment and Hazardous Materials*, p. 9 (November 16, 2005).

Environmental problems can arise at industrial-scale animal feeding operations as opposed to family farms, in part, because large volumes of waste are generated by thousands of animals in confined operations that generally lack adequate facilities and land to appropriately manage the waste. See e.g., U.S. EPA, Risk Assessment Evaluation for Concentration Animal Feeding Operations, (May 2004). As a result, the waste is often managed and disposed of in a manner that results in the release of hazardous substances into the environment. According to EPA, "[o]ne animal facility with a large population of animals can easily equal a small city in terms of waste production" and "[c]urrent practices of waste handling often include minimal or no treatment before the wastes are disseminated into the environment." See U.S. EPA, Risk Assessment, at p. iv.

Water pollution caused by animal waste generated at Concentrated Animal Feeding Operations ("CAFOs") is included as part of the EPA's five national enforcement priorities for fiscal years 2005-2007. See U.S. EPA, *November 2004 – Compliance National Priority*. According to the EPA's 1998 and 2000 National Water Quality Inventory Reports, the agricultural sector, including CAFOs, "contributes to the impairment of at least 170,000 river miles, 2.4 million lake acres, and almost 2,000 estuarine square miles" and is the "leading contributor to identified water quality impairments in the nation's rivers and streams, lakes, ponds, and reservoirs." 66 Fed. Reg. at 2973; 68 Fed. Reg. at 7237. Pollution from animal feeding operations can have significant adverse effects on public health, drinking water supplies, recreation, and aquatic life.

Industrial-scale animal feeding operations can also emit air pollutants that have the potential to adversely affect human health and the environment, such as ammonia, particulate matter and hydrogen sulfide. See *Testimony of Robert Lawrence*, at 4. For example, EPA has reported that animal waste management is the largest source of air emissions of ammonia, a CERCLA hazardous substance, in the United States.[1] In 2003, the National Academy of Science issued a report discussing the environmental and human health impacts of air emissions from animal feeding operations and setting forth recommendations for monitoring, setting standards and reducing emissions. See National Research Council of the Nation Academies, *Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs* (Nat'l Academies Press 2003). In response, the EPA proposed a legal agreement with the animal feeding operation industry, in part, "to address emissions of air pollutants and hazardous substances from certain animal feeding operation(s)" through a national monitoring program.[2] If federal law is amended as proposed by H.R. 4341, an estimated 238,000 industrial-scale animal feeding operations would not be required to report their emissions of hazardous or extremely hazardous substances under either section 9603 of CERCLA or section

[1] The EPA also reports that livestock operations are estimated to produce as much as eighty percent of total ammonia emissions. http://www.epa.gov/ORD/NRMRL/pubs/600r02017/600r02017.pdf.

[2] See http://www.epa.gov/compliance/resources/agreements/caa/cafo-agr-050121.pdf.

11004(a) of EPCRA, thereby depriving the states of important information necessary to respond to the impacts of these facilities on human health and the environment.

Proponents of these exemptions assert that CERCLA and EPCRA should not be utilized to monitor and clean up hazardous substances released into the environment by industrial-scale animal feeding operations. Essentially, they assert that all industrial-scale animal feeding operations are highly regulated under the Clean Water Act and that Congress did not intend for CERCLA to apply to releases of hazardous substances from these operations.

Facilities permitted under the Clean Water Act are not wholly exempt from CERCLA and EPCRA, although there are provisions in the statutes that provide certain protections for facilities in compliance with a federal permit. Regardless, it is critical to understand that, although industrial-scale animal feeding operations are a significant source of pollution across the country, only a small fraction of the operations are actually regulated under the Clean Water Act[3]. As of 2003, the EPA estimated that there were approximately 238,000 animal feeding operations in the United States. See 68 Fed. Reg. at 7179-7180. In 2004, the EPA estimated that only 18,000 animal feeding operations were subject to regulation as CAFOs under the Clean Water Act and only thirty-four percent of those operations had actually obtained permits. See U.S. EPA, *November 2004 – Compliance National Priority: Clean Water Act, Wet Weather, Concentrated Animal Feeding Operations*. Additionally, the CAFO permit is primarily directed at regulating nutrients, as opposed to other constituents such as metals and pathogens. See e.g., 40 C.F.R. § 412.4.

Further, it is clear that Congress intended CERCLA to apply to animal feeding operations that dispose of waste in a manner that releases hazardous substances into the environment. While Congress created an exemption for the "normal application of fertilizer," see 42 U.S.C. § 9601(22)(D) of CERCLA, the legislative history plainly indicates that CERCLA was intended to apply to activities such as dumping, spilling or emitting fertilizer in any place or in amounts significantly greater than are beneficial to crops. See S. Rep. No. 96-848, at 46 (1980)[4]. Similarly, section 11021 of EPCRA contains an exemption from the definition of "hazardous chemical" for substances used in "routine agricultural operations" and release reporting under section 11004(a) is only required when the facility releases regulated substances above the thresholds established to protect public health and the environment. See 40 C.F.R. § 355.40. These provisions are adequate to protect all legitimate uses of animal waste by farmers, while ensuring that the states retain the ability to properly respond to releases of hazardous substances caused by dumping or other improper waste management activities of industrial-scale animal feeding operations.

[3] EPA, by regulation, has determined that it will only regulate primarily the largest of the animal feeding operations, called Concentrated Animal Feeding Operations or CAFOs, under the Clean Water Act. See 68 Fed. Reg. 7179-80.

[4] Specifically, the Senate Report states that "[t]he term "normal field application" means the act of putting fertilizer on crops or cropland, and does not mean any dumping, spilling, or emitting, whether accidental or intentional, in any other place or of significantly greater concentrations or amounts than are beneficial to crops."

Considering the potential nature and magnitude of the pollution caused by industrialized animal feeding operations across the nation, it is important to maintain the authority of the states to appropriately monitor and respond to releases of hazardous substances from these facilities. The proposed exemption of animal waste from CERCLA and EPCRA would severely constrain our ability to protect human health and the environment. Accordingly, we urge you to oppose H.R. 4341.

Thank you for your consideration.

Sincerely,

Bill Lockyer
Attorney General California

Richard Blumenthal
Attorney General Connecticut

Gregory D. Stumbo
Attorney General Kentucky

Zulima V. Farber
Attorney General New Jersey

Patricia A. Madrid
Attorney General New Mexico

W.A. Drew Edmondson
Attorney General Oklahoma

Peggy A. Lautenschlager
Attorney General Wisconsin

OKLAHOMA FARM BUREAU
2501 N. STILES • OKLAHOMA CITY, OK 73105-3126 • 405-523-2300

**STATEMENT OF STEVE KOUPLEN
PRESIDENT OF THE OKLAHOMA FARM BUREAU
AND DIRECTOR ON THE
AMERICAN FARM BUREAU FEDERATION BOARD
TO THE SENATE ENIVROMENT AND PUBLIC WORKS COMMITTEE**

SEPTEMBER 6, 2007

My name is Steve Kouplen. I am president of the Oklahoma Farm Bureau (OFB) and a member of the board of directors of the American Farm Bureau Federation (AFBF). Nationally, Farm Bureau represents the majority of the beef, swine, and poultry producers in the country. Oklahoma Farm Bureau is the largest agriculture organization in our state with more than 166,000 member families.

I am also a cattle rancher from Beggs, located in the eastern part of Oklahoma. Thank you for the opportunity to address water quality and animal manure management issues as they relate to concentrated animal feeding operations and animal feeding operations, otherwise known as CAFOs and AFOs.

There are many federal and state mechanisms already in place to address CAFOs and AFOs and the environmental issues that surround them. Those mechanisms can and do work when they are properly funded and given time to work.

Oklahoma has addressed water quality and animal waste issues through regulatory and non-regulatory mechanisms, including legislation, rulemakings (water quality standards), the federal-state 319 nonpoint source program, state income tax incentives, and USDA Natural Resources Conservation Service's (NRCS) conservation cost share programs. Oklahoma agriculture is also regulated by the Clean Water Act and other federal laws.

In recent years, Oklahoma and Arkansas have been proactive in addressing water quality concerns due to livestock. In about 1996, the Arkansas-Oklahoma Arkansas River Compact Commission agreed to work toward a 40% reduction in phosphorus loading to Tenkiller Lake. The Oklahoma state designated "scenic" Illinois River feeds into Tenkiller Lake. It was agreed the spatial location to track the loading would be Horseshoe Bend, in the upper end of Lake Tenkiller. Since that agreement in 1996, water quality monitoring techniques have evolved. At this time, Oklahoma and Arkansas do not perform joint water quality monitoring in the Illinois River watershed, however they do coordinate their efforts.

In May of 1997, then Oklahoma Governor Frank Keating appointed an Animal Waste and Water Quality Protection Task Force, requesting a final report before December 1, 1997. On December 4, the Governor signed executive orders directing two state agencies to begin implementing key recommendations of the report. That same month, the Governor signed emergency rules for chicken farms, requiring commercial poultry operations to obtain or apply for an approved Animal Waste Management Plan, addressing nitrogen and phosphorus, by January 1, 1999, or if within a (nutrient) threatened watershed, by June 1, 1998.

In April of 1998, the Oklahoma USDA-NRCS revised their Conservation Practice Standard, Waste Utilization (Code 633), with a provision specifically for the Eucha/Spavinaw Watershed (part of the City of Tulsa's drinking water supply) in Oklahoma and Arkansas. The standard applied to the Oklahoma portion of the watershed restricted poultry litter application on land with a phosphorus index of 300 lbs/acre or greater.

On July 1, 1998, legislation became effective which regulated commercial poultry feeding operations in Oklahoma.

In July 1, 2000, an Oklahoma Water Resources Board rule defining nutrient limited watersheds and nutrient limited groundwater became effective. Based on the law passed in 1998, poultry producers in nutrient limited watersheds and nutrient limited groundwater areas are required to test their soil prior to litter application every year, rather than every 3 years as is required for non-nutrient limited watersheds.

In April of 2001, the Oklahoma USDA NRCS published Conservation Practice Standard, Nutrient Management (Code 590), replacing the Waste Utilization (Code 633) standard from 1995 and 1998. The new standard made phosphorus, rather than nitrogen, the limiting factor in all nutrient management plans. In non-nutrient limited watersheds, the phosphorus index has an upper limit of 400 lbs/acre, after which no additional litter may be applied. In nutrient limited watersheds, 300 lbs/acre is the threshold. The standard is applicable statewide. Although the Oklahoma USDA NRCS is not a regulatory agency, state law requires animal waste management plans for registered poultry feeding operations to use the NRCS (Code 590) standard.

It should be noted that Oklahoma was one of the first states in the Nation, if not the first state, to require animal waste management plans using phosphorus as the limiting factor, rather than nitrogen. Oklahoma's state law regulating poultry operations exceeds the requirements for poultry operations under federal law.

In April of 2003, Arkansas Governor Mike Huckabee signed three new state laws to regulate nutrients in Arkansas: the Arkansas Soil Nutrient Management Planner and Certification Act; the Arkansas Poultry Registration Act; and the Arkansas Soil Nutrient Application and Poultry Litter Utilization Act.

The Arkansas General Assembly's intent behind the Arkansas Soil Nutrient Management Planner and Certification Act was as follows: that the proper application of nutrients is necessary for maximum soil fertility and proper plant growth; failure to properly apply nutrients to soil may result in a waste of a valuable resource and may negatively impact waters within the state; persons developing soil nutrient plans or applying nutrients to soil should have certain knowledge, skills, and abilities to ensure the proper use of soil nutrients; and a certification system must be developed to determine that persons certified have the knowledge, skill, and abilities to properly develop nutrient management plans or properly apply soil nutrients. A.C.A. § 15-20-1002.

The Arkansas Poultry Registration Act requires a poultry feeding operation to submit information regarding: the number and kind of poultry housed or maintained in the poultry feeding operation; the location of the poultry feeding operation; the litter management system used; the litter storage system used and the amount of litter stored; the acreage owned or controlled by the poultry feeding operation and used for land application of litter; the land application practices used by the poultry feeding operation and the amount of litter applied; the amount of litter transferred or otherwise utilized by the poultry feeding operation and the type of transfer or utilization; the poultry processor or processors with which the poultry feeding operation has contracted to provide poultry; and any other relevant information necessary to effect the purposes of the act. A.C.A. § 15-20-904(c).

Pursuant to A.C.A. § 15-20-1108(c)(2), the Arkansas Soil Nutrient Application and Poultry Litter Utilization Act, a poultry litter management plan shall contain a periodic poultry litter nutrient content analysis component and poultry litter utilization component providing for the proper utilization of the litter produced, including provisions ensuring that:

(A) Land application within a nutrient surplus area is in accordance with a nutrient management plan or at a rate not to exceed the protective rate;

(B) Land application outside a nutrient surplus area is in a method and at a rate acceptable to the commission; and

(C) Litter not land-applied is converted to a nonnutrient use or other use acceptable to the commission.

Pursuant to A.C.A. § 15-20-1104(a), the Arkansas General Assembly has declared the following areas to be nutrient surplus areas for phosphorus and nitrogen:

(1) The Illinois River watershed, included within Benton, Crawford, and Washington counties;

(2) The Spavinaw Creek watershed, included within Benton County;

(3) The Honey Creek watershed, included within Benton County;

(4) The Little Sugar Creek watershed, included within Benton County;

(5) The upper Arkansas River watershed, which includes Lee Creek within Crawford and Washington counties and Massard Creek within Sebastian County;

(6) The Poteau River watershed, included within Polk, Scott, and Sebastian counties;

(7) The Mountain Fork of the Little River watershed, included within Polk County; and

(8) The upper White River watershed above its confluence with Crooked Creek.

A "nutrient surplus area" means an area declared by A.C.A. § 15-20-1104(a) in which the soil concentration of one or more nutrients is so high or the physical characteristics of the soil or area are such that continued application of the nutrient to the soil could negatively impact soil fertility and the waters within the state. A.C.A. § 15-20-1103(12).

The Arkansas Soil Nutrient Application and Poultry Litter Utilization Act also has a record component that requires the owner of the poultry feeding operation to maintain sufficient records at the site of the poultry feeding operation to determine poultry litter utilization and compliance with the other portions of the poultry litter management plan. A.C.A. § 15-20-1108(c)(3).

In December of 2003, Oklahoma and Arkansas signed a "Statement of Joint Principles and Actions," outlining how the states would work together to improve water quality in Oklahoma's scenic rivers.

From the "Statement of Joint Principles:"

> *The states agree to work on a joint watershed plan, as follows: The states of Arkansas and Oklahoma, acting through their environmental agencies, will work together in partnership with the Arkansas-Oklahoma Arkansas River Compact Commission toward the goal of producing a Watershed Plan. (Note: EPA's Clean Water Act Section 319 guidance sets out nine (9) elements for a Watershed Plan.)*

It is my understanding pursuing a watershed plan has been put on hold, pending the outcome of the *State of Oklahoma vs. Tyson Foods, et. al.*, an ongoing lawsuit asserting claims under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the federal Solid Waste Disposal Act. The lawsuit alleges natural resources damages in the Illinois River watershed as a result of the improper application of poultry litter as fertilizer within the watershed.

There are a number of Oklahoma state actions and responsibilities that address water quality generally, and in the Illinois River watershed. The Oklahoma Department of Agriculture Food and Forestry (ODAFF) has jurisdiction over point and nonpoint source pollution relating to agriculture production. The Department may take legal action against polluters at any time it deems necessary.

Identified through the locally led process, the USDA NRCS State Technical Committee prioritized the following natural resource concerns as being significant to the State of Oklahoma: Management of Eastern Redcedar on Rangeland; Surface Water Concerns from Nutrients and Organic Contaminants; Classic Gully Erosion on Grazingland; Sheet and Rill Erosion on Cropland; Streambank Erosion; and Irrigation Water Management. Surface water concerns and streambank erosion are directly related to water quality issues in Oklahoma.

The Oklahoma USDA NRCS has a program to provide assistance for Animal Waste Management for Animal Feeding Operations statewide. These funds are available only to existing and expanding beef, dairy, or swine confined feeding operations. A lower priority is given to operations that are planning expansion beyond current levels or capacity, and all applications for new facilities and poultry operations are ineligible for evaluation under the Statewide AFO/CAFO Resource Concern Criteria. This allows AFO/CAFO operations to apply for Environmental Quality Incentive Program financial assistance for the storage, treatment, and utilization of animal waste.

The Oklahoma USDA NRCS has a program called Statewide Manure Transfer Resource Concerns. Potential environmental concerns relative to the management of animal wastes in Oklahoma's Nutrient Limited Watersheds (NLW) and Scenic River watersheds continue to be a high priority for the Oklahoma USDA NRCS State Technical Committee. As a result, new Statewide Manure Transfer Resource Concerns have been developed to address the two primary objectives: (1) create an incentive to distribute animal manure to areas of the state that have historically not used animal manure as a fertilizer; and (2) promote a long-term market for animal manure as a fertilizer around the state. In 2006, $312,000 was made available to move poultry litter west of the Illinois River Watershed.

Today, there are even more recent developments to address water quality concerns. The litigation by the Oklahoma attorney general against the Arkansas poultry industry has not stopped the efforts of private individuals to address water quality concerns within the Illinois River watershed. The Illinois River Watershed Partnership (Partnership) is a citizen-based non-profit organization. The Partnership is not affiliated with any state or federal agency. It is made up of landowners and stakeholders within the Illinois River watershed in Oklahoma and Arkansas. The purpose of the Partnership is to work together on voluntary projects to address water quality concerns within the watershed. One of their goals is to put together an Oklahoma-Arkansas watershed management plan for the watershed.

The poultry industry has also been proactive in protecting Oklahoma's water. Arkansas poultry companies have gifted $1.1 million over four years to the Oklahoma Scenic Rivers Commission to benefit the Illinois River watershed. That money is being used to pay for United States Geological Survey gauging sites on the scenic rivers, water quality monitoring, portable bathrooms along the scenic rivers, and cost share money for conservation practices and riparian restoration. The lion's share of the money is going toward the Conservation Reserve Enhancement Program project, or CREP.

A variety of incentives have been utilized to move poultry litter out of nutrient limited watersheds. In 2004, the Oklahoma Legislature created a $5 per ton poultry tax litter credit. There is an annual cap on this fund of $375,000. In 2005, the Legislature extended the tax credit for three more years. To qualify for the $5 per ton tax credit, litter must be purchased only from an Oklahoma-based poultry operation registered with ODAFF and located within an environmentally sensitive and nutrient-limited watershed area. Additionally, there are 319 (nonpoint source funds from the Oklahoma

Conservation Commission) and Oklahoma USDA NRCS Program funds being used to move litter out of sensitive areas.

The Illinois River watershed, was designated a 319 priority area by the Oklahoma Conservation Commission from 1999-2004. The 319 program targeted funds to the watershed and used cost-share monies to fund several educational conservation practices. The Oklahoma Conservation Commission has applied for a new grant for the Illinois River for $1.6 million, which is expected to be approved soon.

On April 23, 2007 Oklahoma signed a $20.6 million cooperative conservation partnership agreement between USDA and Oklahoma that will create up to 9,000 acres (or 370 miles) of riparian buffers and filter strips under the Conservation Reserve Enhancement Program or CREP. The conservation plantings will reduce the flow of nutrients, sediment and other pollutants in the Eucha/Spavinaw Lakes and Illinois River/Lake Tenkiller watersheds. Through CREP, USDA and the state of Oklahoma will help landowners and operators establish effective conservation practices to enhance water quality in eastern Oklahoma. Key CREP partners also include the Oklahoma Conservation Commission (OCC), Oklahoma Scenic Rivers Commission, City of Tulsa, local Soil and Water Conservation Districts, the USDA Commodity Credit Corporation (CCC), FSA and USDA NRCS.

The Oklahoma CREP includes parts of Adair, Cherokee, Delaware, Mayes and Sequoyah counties and includes participation by the conservation districts in those counties. The project seeks to filter runoff, stabilize stream banks, shade stream channels, and improve drinking water and aquatic habitat by creating 500 acres of filter strips and 8,500 acres of riparian buffers, for a total of 9,000 acres, or 370 miles, of protected streams.

Landowners participating in the program will receive annual rental payments, financial and technical assistance and other incentives for voluntarily enrolling land into contracts. The Farm Service Agency will administer the Oklahoma CREP, with support from state CREP partners. Eligible landowners will receive a one-time Practice Incentive Payment and a one-time Signing Incentive Payment. In addition, federal dollars will pay 50 percent of the reimbursable costs of establishing eligible practices, conducting compliance reviews, and providing technical assistance and other services up to $16.5 million for the Oklahoma CREP.

The Oklahoma Conservation Commission oversees implementation of CREP. The OCC collaborates with local conservation districts, to identify eligible producers with appropriate land for enrollment in the program. The state of Oklahoma provides payments to participants and pays a minimum of 20 percent of the overall costs of the Oklahoma CREP, including payments for fencing and related costs for non-Conservation Reserve Program (CRP) acreage. OCC will also provide staffing for the project, and coordinates with other natural resource conservation programs at the local, state and federal levels.

As you can see, there are a wide variety of regulatory and non-regulatory means that are being used to address water quality and animal manure management concerns in Oklahoma. In regards to animal manure itself, SB 709 was recently signed into law to clarify that animal manure shall not be classified as a hazardous waste or substance under Oklahoma law. SB 709's definition of animal manure includes all types of livestock. ODAFF remains responsible for the regulation of animal manure as a soil nutrient.

Also signed into Oklahoma law was HB 1490, which directed the ODAFF to promulgate rules to implement the phosphorus index as agreed to in the federal court settlement of *The City of Tulsa vs. Tyson Foods, et. al.,* filed in the United States District Court for the Northern District of Oklahoma in December, 2001. Oklahoma poultry growers in the Eucha/Spavinaw Watershed were already operating under the terms of the settlement which limits application of poultry litter.

I hope this testimony demonstrates that states are proactive in addressing water quality concerns due to livestock. States often have regulations stricter than what is required under federal law. The heritage and livelihoods of farming and ranching families is closely connected to the land and water, preserving a healthy, safe and clean environment for their livestock and crops.

NACAA
national association of clean air agencies

March 20, 2007

The Honorable Barbara Boxer
Chairman
Environment and Public Works Committee
456 Dirksen Senate Office Building
Washington, DC 20510-6175

Dear Senator Boxer:

We are writing in response to recent testimony provided by EPA Administrator Stephen Johnson before the Senate Environment and Public Works Committee regarding EPA's plan to exempt emissions of air pollutants from manure from reporting requirements under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Emergency Planning and Community Right to Know Act (EPCRA). Administrator Johnson indicated at a hearing held on March 7, 2007, that state and local officials implementing Title III of the Superfund Amendments and Reauthorization Act consulted by EPA did not object to eliminating the CERCLA and EPCRA reporting requirements for ammonia and hydrogen sulfide emissions from manure.

However, what Mr. Johnson failed to mention is that EPA staff also sought the input of state and local air pollution control agencies, who voiced a different view. During a conference call EPA's Office of Solid Waste and Emergency Response held with the National Association of Clean Air Agencies (NACAA) on November 9, 2006, we expressed several concerns to EPA about exempting from EPCRA and CERCLA the reporting of emissions of ammonia and hydrogen sulfide from manure, which we discuss below:

- Ammonia and hydrogen sulfide are air pollutants with demonstrated health effects. Human exposure to ammonia triggers respiratory problems, causes nasal and eye irritation and in large enough amounts can be fatal.[1] It also contributes directly to the formation of fine particulate matter ($PM_{2.5}$), which causes severe health effects in people, including death, heart attacks and increased severity of asthma attacks, as well as visibility impairment.[2] Hydrogen sulfide is a toxic air pollutant that can cause severe health effects, even death, at high concentrations

[1] Schiffman, S.S., et al., *Health Effects of Aerial Emissions from Animal Production and Waste Management Systems*, available at http://www.cals.ncsu.edu/waste_mgt/natlcenter/summary.pdf and Agency for Toxic Substances and Disease Registry, "Public Health Statement for Ammonia" (September 2004), available at http://www.atsdr.cdc.gov/toxprofiles/phs126.html#bookmark05.
[2] EPA, "Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information," (OAQPS Staff Paper) (December 2005), available at http://www.epa.gov/ttn/naaqs/standards/pm/data/pmstaffpaper_20051221.pdf.

of exposure.[3] As reported in the *Dayton Daily News*, "At least 24 people in the Midwest have died from inhaling hydrogen sulfide and methane from manure since the 1970s, including fifth-generation Michigan dairy farmer Carl Theuerkauf and four members of his family, who collapsed one by one in 1989 after breathing methane gas from a manure pit."[4]

- Air emissions from animal farming operations (AFOs) are not trivial. AFO ammonia emissions represent *half* the U.S. ammonia emissions inventory.[5] Monitoring conducted of Premium Standard Farms (PSF) by EPA (under a settlement agreement) in 2004 shows that PSF releases 3 million pounds of ammonia annually from barns and lagoons at its Somerset facility, making it the fifth largest industrial emitter of ammonia in the country.[6] In Iowa, the greatest number of air complaints the state air agency receives concern emissions from manure storage pits. Iowa monitored ten homes for ammonia and hydrogen sulfide emissions and recorded high ammonia emissions on a regular basis and high hydrogen sulfide emissions periodically.[7]

- AFOs produce millions of tons of manure each year. According to EPA, AFOs generate approximately 500 million tons of waste each year, three times more raw waste than is generated yearly by people in the U.S.[8] Thus, manure is not a minor source of air emissions.

- Given the paucity of monitors in rural states, CERCLA and EPCRA reports may be the only source of information to people affected by excessive air emissions from AFOs.

- EPA is currently conducting a monitoring study to collect information about the air emissions from AFOs and to determine whether air emissions from AFOs, including emissions from manure, warrant regulation. EPA should not consider a blanket exemption from reporting requirements for air pollutant emissions from manure while data on this very subject is being collected. (Farms participating in this monitoring study have already received a waiver from enforcement of CERCLA and EPCRA reporting provisions for air emissions of hydrogen sulfide and ammonia.)[9]

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[3] Agency for Toxic Substances and Disease Registry, "Public Health Statement for Hydrogen Sulfide" (July 2006), available at http://www.atsdr.cdc.gov/toxprofiles/phs114.html.

[4] Wagner and Sutherly, "The supersizing of America's livestock farms," *Dayton Daily News* (December 1, 2002).

[5] National Research Council, "Air Emissions from Animal Feeding Operations: Current Knowledge, Future Needs" (pre-publication copy released Dec. 12, 2002), at p. 42

[6] Premium Standard Farms, *Air Emissions Monitoring Completion Report* (Nov. 17, 2004) and EPA, "Toxics Release Inventory" (2004), available at http://www.epa.gov/triexplorer.

[7] Iowa Department of Natural Resources Ambient Air Monitoring Group, "Results of the Iowa DNR Animal Feeding Odor Study" (January 2006).

[8] 68 *Federal Register* at pp. 7179-80.

[9] 70 *Federal Register* at p. 4963. Specifically, EPA covenants not to sue participating AFOs – whether or not they are actually monitored – for "civil violations of CERCLA section 103 or EPCRA section 304 from

- We are also concerned about the precedent this action will set with respect to application of the Clean Air Act to air emissions from manure.

In our discussions with EPA, we suggested other means for reducing the perceived regulatory burden and uncertainty with respect to CERCLA and EPCRA: EPA could determine a size threshold for farms, based on animal units, below which a farm might reasonably assume its air emissions of ammonia and hydrogen sulfide were below CERCLA and EPCRA reporting thresholds. We do not believe a blanket exemption is warranted given the demonstrated health effects associated with ammonia and hydrogen sulfide, the amounts of manure produced by AFOs and the usefulness of the data contained in CERCLA and EPCRA reports to state and local air agencies and the people living near these facilities.

On a related issue, we understand that legislation has been introduced to exempt from CERCLA and EPCRA reporting of all air pollutant emissions from manure. We would oppose such a statutory exemption for the same reasons cited above. A legislative exemption is even more problematic because such an exemption would require legislative action to be reversed, as opposed to an EPA interpretation that could be changed administratively.

Please feel free to contact me at 202-624-7864 if you have any questions.

Sincerely,

S. William Becker
Executive Director

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air emissions of Hydrogen Sulfide (H_2S) or Ammonia (NH_3) that are not singular unexpected or accidental releases such as those caused by an explosion, fire or other abnormal occurrence."

NACCHO
National Association of County & City Health Officials

August 31, 2007

The Honorable Barbara Boxer
Chairman
Senate Environment and Public Works Committee
410 Dirksen Senate Office Building
Washington, DC 20510

The Honorable James Inhofe
Ranking Member
Senate Environment and Public Works Committee
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Boxer and Senator Inhofe:

On behalf of the nation's local public health officials, I write to express our opposition to any attempt to amend the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) in a manner that would adversely affect the ability of local governments to protect the health of their communities.

Proposed legislation (S. 807) would provide blanket exemptions from CERCLA for substances associated with concentrated animal feeding operations (CAFOs) that can threaten the public's health. The measure would preclude manure from being considered a "hazardous substance" under Section 101(14) and from the definition of a "pollutant or contaminant" under Section 101(33) of CERCLA. This change is unnecessary and unwise for several reasons. Manure is not considered a hazardous substance, pollutant or contaminant under CERCLA. Further, CERCLA already has an exemption for the normal application of fertilizer that would include manure. However, phosphorus, a constituent present in manure, is a hazardous substance under CERLCA which can pollute drinking water sources affected by animal feeding operations. If an exemption for manure were to be added to CERCLA, communities could be precluded from cost recovery for pollution beyond the normal application of fertilizer currently permitted under CERCLA.

This legislation would also exempt dangerous substances emitted by CAFOs from notification requirements under CERCLA, thereby depriving local health officials of the information that they need to protect the public's health. Large amounts of animal waste have been associated with CAFOs. Several pathogens commonly found in animal waste have been found in contaminated drinking water and have caused severe disease outbreaks. The Environmental Protection Agency has found that "improperly managed manure has caused serious acute and chronic water quality problems throughout the United States." Byproducts of animal wastes such as hydrogen sulfide, ammonia, and particulate matter have been associated with increased air pollution and smog. Animal waste may contain antibiotics which can contribute to antibiotic resistance in humans. Local health officials cannot take precautions to notify the public of health hazards if they do not have appropriate information about potential contaminants.

I urge you and your colleagues to oppose efforts to provide exemptions for manure under CERCLA, whether as a stand alone bill or an amendment to a larger piece of legislation such as the Farm Bill. Please feel free to contact me with any questions regarding this important public health issue.

Sincerely,

Patrick M. Libbey

Patrick M. Libbey
Executive Director

STATEMENT OF ARLEN L. LANCASTER, CHIEF
NATURAL RESOURCES CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
BEFORE THE
UNITED STATES SENATE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

September 6, 2007

Madam Chairwoman and Members of the Committee:

Thank you for the opportunity to appear before the Committee to describe the activities of the Natural Resources Conservation Service (NRCS) in providing assistance to landowners in addressing water quality, particularly as it relates to confined livestock operations. My name is Arlen Lancaster, and I serve as the Chief of NRCS. As Chief, I have been fortunate to experience firsthand some of the amazing conservation work that farmers, ranchers, and other private landowners are performing by working hand-in-hand with local NRCS staff and our many partners.

Through the technical assistance and program financial assistance NRCS administers, our employees work in partnership with private landowners to take proactive steps to improve water quality and assist producers in complying with local, State and national regulatory requirements across the Nation.

Helping People Help the Land

For over 70 years, NRCS has been committed to working with America's private landowners through a locally led, voluntary cooperative conservation approach. Because of this "ground-up" approach to helping people, we describe our mission as "helping people help the land." The phrase is succinct and it effectively describes what we do, so our Agency has adopted "helping people help the land" as our mission statement. Even though the words help others understand what we do as an Agency, the concept of working closely with America's agricultural producers encompasses a commitment to providing quality service with improved environmental benefits and a healthier landscape.

Importance of Clean Water

Water quality is an important indicator of the health of our environment and reflects what occurs on the land. NRCS helps farmers improve their land in an environmentally sound manner. Below are a few examples of recent activities we have undertaken that demonstrate our commitment to addressing water quality issues:

- Developed United States Department of Agriculture (USDA) policy on market-based incentives and signed a Partnership Agreement with the U.S.

Environmental Protection Agency (EPA) to further the market-based approach.
- Signed a Memorandum of Understanding (MOU) with EPA to refocus efforts in implementing the Chesapeake Bay Program.
- Assisted landowners in treating over 42 million acres with conservation measures.
- Provided financial and technical assistance to aid landowners in developing and implementing approximately 28,400 Comprehensive Nutrient Management Plans (CNMPs) for livestock manure management since fiscal year (FY) 2002, including over 5,000 CNMPs in FY 2006.
- Accelerated the preparation of future CNMPs with upgrades in Agency supported software being completed in 2007.

The result is better water quality for drinking, recreation, wildlife, fisheries and industry. Water quality concerns from agriculture are generally defined as non-point source (NPS) pollution. NPS is pollution that comes from diffuse sources. This can make identification of the source of a water quality problem difficult. Often a water quality problem from NPS is the result of actions by many landowners, both rural and urban. Consequently, solutions to NPS water quality problems can be difficult to determine and contentious to implement. While other sources of NPS such as urban runoff can be significant, agriculture receives considerable attention because of the large percentage of land in agriculture use, about 48 percent in the continental United States. There are many changes agriculture producers can and have made voluntarily often with technical and financial assistance available through a variety of sources. Farmers in many parts of the country are using these programs to implement reduced tillage and other forms of residue management, develop and implement CNMPs, and install conservation buffers.

Farmers and ranchers know that sound, profitable farming and maintaining clean water supplies go hand-in-hand; and through our technical assistance, cost-share, reserve, and stewardship programs, we are assisting the agriculture and forestry sectors to realize their tremendous potential to provide increasing positive environmental benefits.

Working Lands and Conservation Planning

Conservation Technical Assistance (CTA)

The focus of NRCS's conservation efforts is squarely centered on working lands and on ensuring that these lands continue to produce valuable agricultural commodities and contribute to local economies, while at the same time protecting our soil, water, fish and wildlife habitat and other related natural resources. For NRCS, this has always meant voluntary, incentive-based conservation activities. This approach has proven time and again that when given sound information, guidance, and technical assistance, farmers and ranchers voluntarily adopt, install, and maintain conservation practices. Locally-led conservation that is developed cooperatively with farmers and ranchers produces more effective, long-lasting, and economically viable results than regulation and other mandatory approaches.

Madam Chairwoman, if you visit any one of the 3,077 counties in the United States, you would likely find that agricultural producers have a relationship with NRCS local staff founded upon the technical knowledge and resources that are available through our local field offices. This technical assistance is funded through the Conservation Technical Assistance (CTA) Program, which provides direct conservation planning and implementation assistance. This program provides the infrastructure and technical capability for our Agency to assist program participants to apply conservation on the land.

With CTA Program assistance, a producer identifies the unique resource concerns of his/her operation as a starting point and develops a conservation plan. This conservation plan is the foundation of locally-led cooperative conservation. In essence, a producer's conservation plan is a roadmap and decision-making tool for the future management of his/her operation. The plan is dynamic, providing different options for different situations (weather, markets, cropping patterns) and can be modified as conditions change, or as the producers establish new production or conservation priorities.

The same program assistance is also used to aid producers who have CNMPs developed for CAFOs. The CNMP identifies management and conservation actions that the producer will follow to meet clearly defined soil and water conservation goals on their CAFO. Defining soil and water conservation goals and identifying measures and schedules for attaining these goals are critical to maintaining water quality and public health.

Once the CNMP is developed and individual farmers or ranchers decide to adopt specific conservation practices or systems, they may utilize assistance from the suite of cost share, reserve, or stewardship programs that NRCS offers through the Farm Bill and other authorities. NRCS administers 23 conservation programs. While each program provides important and demonstrable natural resource improvements, the specific programs with a priority for improving water quality are as follows:

Working Lands Cost-Share Programs

Environmental Quality Incentives Program

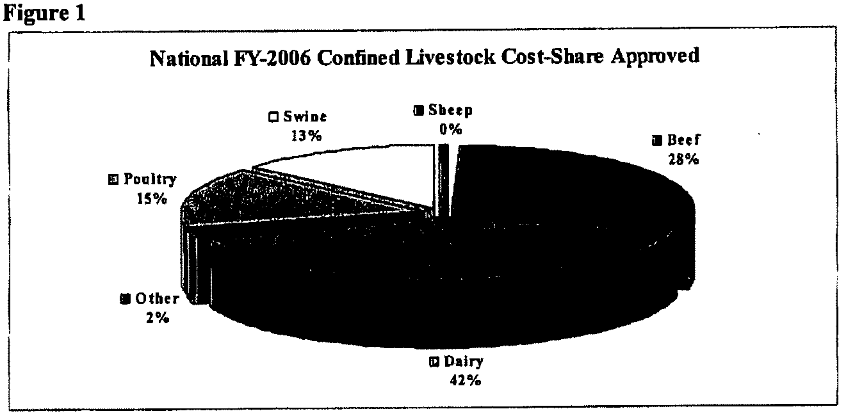
The Environmental Quality Incentives Program (EQIP) is our flagship working lands conservation program. The objective of EQIP is to optimize environmental benefits, which begins with addressing five national priorities including reduction of nonpoint source pollution, conservation of ground and surface water resources, reduction of emissions, reduction of soil erosion and sedimentation from agricultural lands, and promotion of at-risk species habitat. The program provides technical and financial assistance to landowners that face serious natural resource challenges in their management of cropland, grazing lands, livestock, and wildlife habitat.

Funding for EQIP in the 2002 Farm Bill greatly expanded the program's availability. Including funding obligated in FY 2002 through FY 2006, totaling almost $3.1 billion, EQIP will benefit close to 185,000 participants. In addition, EQIP leverages additional funding from landowner match requirements and State and local cost-share programs. For individuals, the Federal share can be up to 75 percent, and up to 90 percent for limited resource farmers and ranchers, beginning farmers and ranchers and socially disadvantaged farmers and ranchers. Sixty percent of total EQIP funds are directed to address livestock-related resource concerns.

In FY 2006, over 61 percent or $483 million was obligated for assisting livestock producers. Of that amount, nearly one-third ($152 million) went to confined livestock operations.

Figure 1 provides more details on the confined livestock operations which benefited from EQIP funding in FY 2006.

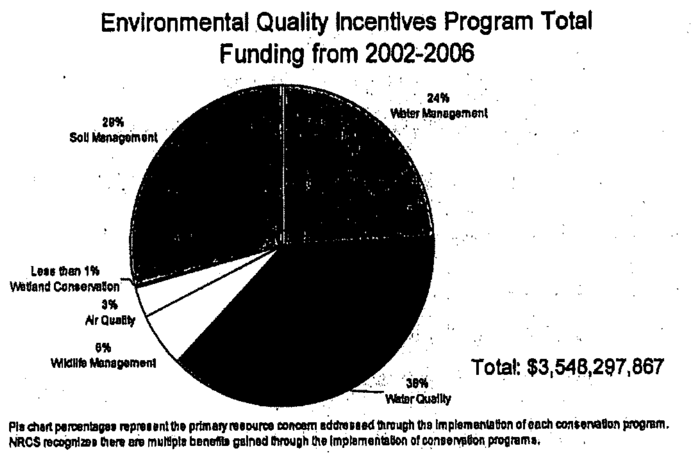
Figure 1



We have also been able to increase program flexibility and improve program features to make EQIP one of the most popular and effective conservation efforts in the Federal Government. For example, in 2007, we significantly increased the funding available for the development of CNMPs by allowing the use of financial assistance (FA) monies. States were encouraged to establish incentive payments at an amount and rate necessary to encourage a participant to develop a CNMP. Funding should be sufficient to cover the cost of a Technical Service Provider to develop the plan and mitigate the risks associated with a change in management practices.

Figure 2 demonstrates the broad range of natural resource issues that EQIP addresses, including 38 percent of funding going toward water quality improvement practices.

Figure 2



In the Department's 2007 Farm Bill proposal, it is recommended to consolidate and reauthorize existing cost-share programs such as the Environmental Quality Incentives Program, the Wildlife Habitat Incentives Program, the Agricultural Management Assistance Program, the Forest Land Enhancement Program, the Ground and Surface Water Conservation Program and the Klamath Basin Program into a newly designed EQIP which will simplify and streamline activities, reduce redundancies and produce more cost-effective environmental benefits. It will increase program funding by about $7.8 billion and allow easier program access for producers. The Department's 2007 proposal also includes the creation of a new Regional Water Enhancement Program within EQIP that focuses on cooperative approaches to enhancing water quality and/or quantity on a regional scale.

- **Conservation Innovation Grants**

Authorized under EQIP in the 2002 Farm Bill, NRCS also offers the Conservation Innovation Grants (CIG) program. CIG is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies for agricultural production while leveraging Federal investment in environmental enhancement and protection. Under CIG, competitive grants are awarded to eligible entities, including State and local agencies, non-governmental organizations, tribes, or individuals. CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations.

In FY 2007, a total of $20 million in EQIP funding was made available for CIG which was implemented with three components: National, Chesapeake Bay Watershed, and State. The grants stimulated the development and adoption of innovative technologies and approaches through pilot projects and conservation field trials.

One example of the kind of project funded through this program that benefits water quality in the Chesapeake Bay is a study of the effects of Precision Dairy Feeding to Reduce Nutrients by the Chesapeake Bay Foundation. The goal was to reduce agricultural non-point source pollution, due to excessive loadings of sediment and nutrients from livestock manure. Precision dairy feeding was identified as a critical component to reduce non-point agricultural water pollution. Through this project, the Chesapeake Bay Foundation and its partners worked with Pennsylvania dairy producers to bring about significant changes in the dairy industry's standard feeding practices to reduce phosphorus intake through feeding and to improve water quality.

Working Lands Stewardship Program

Conservation Security Program

The Conservation Security Program (CSP), as authorized by the 2002 Farm Bill, is a voluntary program that provides financial and technical assistance for the conservation, protection, and improvement of natural resources on tribal and private working lands. This working lands program provides payments for producers who practice good stewardship on their agricultural lands and incentives for those who want to do more.

In the 4-year period this program has been in operation, NRCS has offered the program in 280 watersheds and has rewarded nearly 19,400 stewards on 15.5 million acres of working agricultural land.

CSP enhancements for nutrient management, energy management and air management all have activities that can benefit CAFO's. For instance, nearly 14.6 million acres of enhancements for nutrient management (several enhancements may cover the same acreage) are included in CSP contracts from 2004 through 2006. This 14.6 million acres include both benchmark and new enhancements.

A typical CSP contract was recently awarded to a New Castle County grain operator in Delaware. This landowner then worked cooperatively with NRCS to improve water quality in the Chesapeake Bay. The landowner created and restored wetlands, installed conservation buffer strip, developed wildlife habitats for waterfowl, and utilized irrigation water management, filter strips and no-tillage to protect both soil and water resources. The Department's 2007 Farm Bill proposal would expand total CSP enrollment to 96.5 million acres over the next 10 years.

Conservation Use Programs for Reserving Lands

Wetlands Reserve Program

The Wetlands Reserve Program (WRP) is a voluntary program through which landowners are paid to retire eligible lands from agricultural use if those lands are restored to wetlands and protected, in most cases, with a long-term (30 years) or permanent easement. Landowners receive fair market value for the rights they forgo associated with protecting the land, and are provided with cost-share assistance to cover the restoration expenses. The goal of WRP is to maximize wildlife benefits and wetland functions and values. One of the important functions and values of wetlands is improved water quality and quantity. WRP is the principle USDA program to help meet the President's Wetlands Initiative goal to create, restore and enhance 3 million acres of wetlands by 2009. Properly functioning wetlands have a tremendous positive impact on water quality. Private landowners have enrolled over 1.9 million acres in this program through FY 2006.

Our 2007 Farm Bill proposal seeks to add more than 1 million additional acres to WRP, bring the overall enrollment to more than 3.5 million acres or the size of the State of Connecticut.

Conservation Reserve Program

The Conservation Reserve Program (CRP), administered by the Farm Service Agency, provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. There are more than 36 million acres enrolled in the program and planted to cover crops to stop soil and nutrients from washing into waterways. Through January 2007, CRP has restored 2 million acres of wetlands and 2 million acres of buffers. CRP reduces soil erosion across the Nation by 454 million tons each year. The Administration's 2007 Farm Bill proposal would reauthorize the CRP for an additional 10 years.

Working Lands Future Based Incentives

Using the market to promote conservation is an important part of our future. For example, the Natural Resources Conservation Service strategic plan draws on three closely linked, overarching strategies that support one another: Cooperative Conservation, the Watershed Approach and the Market Based Approach. The goal is to broaden the use of voluntary market mechanisms for the provision of environmental and ecosystem services. These mechanisms include water quality credit trading, mitigation banking, competitive offer-based auctioning and eco-labeling. New market-based approaches will complement our existing programs, while broadening the opportunities for conservation.

Let me give you an example of a project involving water quality trading by agricultural producers who live and farm in New York City watershed. Instead of building a multi-billion dollar filtration plant, the city worked with local landowners and agribusiness to address water quality issues on nearly 500,000 acres of farm and forest land in the watershed that provides the residents of New York City with drinking water. NRCS provided the technical assistance for this project and the City of New York provided the financial assistance. This collaborative effort between local, State and Federal stakeholders resulted in improved water quality in the basin and the avoidance of filtration, saving the City $4 to $8 billion in capital costs.

Working Lands Information Tools

Part of our role at USDA is to help provide information and the tools necessary for our customers and partners, so they can make good land use decisions. We are continually working on new tools. Every year, NRCS measures the changes to the resource base on private lands through the National Resources Inventory (NRI). The NRI is a statistical survey of natural resource conditions and trends and it assesses soil erosion, land cover and use, wetlands, habitat diversity, selected conservation practices and related resources. In 2006, the NRI shows a 43 percent reduction in cropland soil erosion between 1982 and 2003. The NRI, in cooperation with Iowa State University, found that total tons of soil eroded declined in all major river basins. This remarkable reduction did not happen by chance, or by regulation. Rather, it was achieved through extraordinary efforts and voluntary cooperation at the local level.

We also offer soil data through our web soil survey, which provides basic, fundamental information to guide land use decisions. It is part of our ongoing effort to make sure the latest information is available and easily accessible over the Internet.

Measuring Success

Madam Chairman, we have made significant progress in helping people help the land by providing technical and financial support to the Nation's agricultural producers. But while we have excellent information about our program outputs, we still are working to quantify our data on the environmental outcomes of our programs.

As a result, starting in 2003, NRCS, in collaboration with other USDA and Federal agencies, initiated the Conservation Effects Assessment Project (CEAP) to scientifically assess the environmental and related outcomes from Farm Bill conservation programs at both the national and watershed scale through 2008.

The national assessment initially focuses on water quality, soil quality, and water conservation benefits from cropland programs, including the Conservation Reserve Program. Using the Natural Resources Inventory (NRI), supplemented by farmer surveys and verified by USDA computer models, CEAP will estimate national benefits from conservation practices and programs. In addition to the cropland component, the CEAP includes wetlands, grazing lands and wildlife components in the assessment of conservation benefits from Farm Bill programs.

We believe that farmers and ranchers are making important gains in conservation on working lands. They have applied conservation systems to over 57 million acres of cropland and over 108 million acres of grazing lands, and improved 56 million acres of fish and wildlife habitat. We are excited to capture these data and more precisely measure the real results we are helping our customers achieve.

Summary

As we look ahead, it is clear that the challenges before the Nation to protect and improve water quality will require the dedication of all available resources – the skills and expertise of the NRCS staff, the contributions of volunteers, and continued collaboration with partners including local, State and Federal agencies.

I am proud of the work and the conservation ethic our people exhibit day in and day out as they go about the job of achieving conservation on the ground. Through Cooperative Conservation, we have achieved a great deal of success. We are sharply focusing our efforts and will work together with our partners to continue to make improvements to water quality. I look forward to working with you, as we move ahead in this endeavor.

This concludes my statement. I will be glad to answer any questions that Members of the Subcommittee might have.

Congress of the United States
House of Representatives
Washington, D.C. 20515

May 12, 2006

MYTH VS. FACT:
Animal Feeding Operations, Protection of Drinking Water Supplies & the Superfund Law

Dear Colleague:

Efforts are underway to eliminate all existing authorities from the Superfund statute that have been used by cities (Waco, Texas, and Tulsa, Oklahoma) and States (Oklahoma) to protect local watersheds and drinking water supplies. The bill seeking to accomplish this is H.R. 4341. It should not be enacted.

As Ranking Members of the Committees with jurisdiction over Superfund and the Clean Water Act, we wish to clarify some of the common misperceptions that have been created:

Myth: Manure is at risk of being classified as a "hazardous waste."
Fact: *Manure is not classified as a "hazardous waste." There have been three cases brought in the 25-year history of the Superfund program. In each of the cases, the contaminant in question was phosphorous, a hazardous substance under Superfund, that had allegedly come from agricultural operations and that had contaminated local drinking water supplies and watersheds and resulted in additional treatment costs for the city ratepayers or, in the case of the State of Oklahoma, damages to the Illinois River watershed.*

Myth: Congress did not intend to apply the Superfund law to "manure."
Fact: *Congress specifically considered the application of fertilizer and created a legal exemption for the normal application of fertilizer:*

> *"Section 101(22), the term 'release'...excludes... (D) the normal application of fertilizer."*

Legislative history defines the term "normal field application" as "the act of putting fertilizer on crops or cropland, and does not mean any dumping, spilling, or emitting, whether accidental or intentional, in any other place or of significantly greater concentrations or amounts that are beneficial to crops." (S. Rep. No. 96-848, at 46 (1980)).

Congress also created another prohibition on the recovery of response costs or damages under the Superfund statute for "federally permitted releases" (Section 107(j) and Section 101(10)). Thus, if an animal feeding operation is compliant with a permit under the Clean Water Act there is no liability under the Superfund statute.

Myth: Animal agriculture operations are already highly regulated under the Clean Water Act and Clean Air Act. These regulations provide for permitting, enforcement, and remediation.
Fact: *Clean Water Act regulations on the application of manure associated with animal feeding operations are under attack by some in the agriculture industry. Neither the Clean Air Act nor the Clean Water Act contain provisions authorizing State or Federal Trustees to seek recovery of damages for injury to, or destruction of, natural resources. Further, Superfund is the only federal statute that allows for State and local governments to recover cleanup costs from parties responsible for contamination of local drinking water supplies.*

Myth: If "manure" is not exempted from liability under the Superfund law, all farms, large and small, would be at risk of operational uncertainty, impending litigation and potential liability for commercially acceptable practices and naturally occurring organic materials produced at their farming operations.
Fact: *There is no reason to believe that any farms, large or small, are in danger of being held liable under Superfund for response costs or damages as long as they are applying manure in quantities that are beneficial to crops OR are in compliance with a Clean Water Act permit.*

Myth: If "manure" is not exempted from liability under the Superfund law, all farms, large and small, would be at risk of being designated as Superfund sites.
Fact: *No farm has ever been designated a Superfund site due to fertilizer releases. Only the President can designate a farm as a Superfund site, after a notice and comment period. This is a discretionary function; no lawsuit or other legal action can force the President to designate a facility on the Superfund National Priorities List. Superfund designations affect only the most severely contaminated sites.*

For more information, please contact Dick Frandsen of the Committee on Energy and Commerce Democratic staff at ext. 5-3641 or Ken Kopocis of the Committee on Transportation and Infrastructure Democratic staff at ext. 5-0060.

Sincerely,

JOHN D. DINGELL

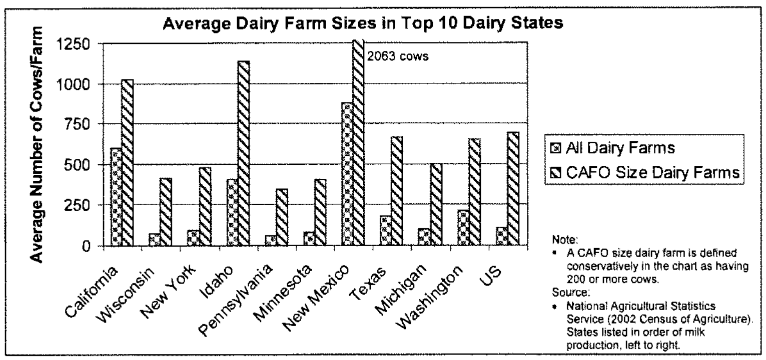
JAMES L. OBERSTAR

New York State Department of Agriculture & Markets

Agricultural Environmental Management Program
and
Concentrated Animal Feeding Operation Permit
Overview

Dairy Farming – Key to Sustainable Development in New York State

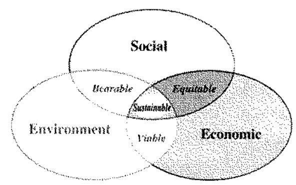
In contrast to livestock farms in most other regions of the United States, the farms regulated by the Concentrated Animal Feeding Operation (CAFO) permit in New York State are not that large and concentrated. The vast majority of farms regulated by CAFO in New York State are modestly sized, family run dairy farms, which have expanded over the years to provide livelihoods for younger generations.



These dairy farms in New York are inherently more sustainable than large livestock farms in many other regions often covered in the media, because New York dairies have the rainfall and soil resources which allow them to economically grow their own forage crops for their cows on their own land. That is, they have a market-driven incentive to maintain a supporting land base for crop production which is fertilized by recycling nutrients from the herd. Swine and poultry farms rely on corn and soybeans for most of their nutritional requirements. These materials are readily moved by truck or rail around the country and the world. As a result, many swine or poultry farms choose to focus solely on animal husbandry, own very little land base and buy grain from farmers many states away (the North Carolina swine model is an example). By contrast, dairy farms often rely on forage for 50% or more of the herd diet. In New York, forage means bulky corn silage or hay that cannot be trucked long distances. As a result, New York dairies rely on a nearby land base for growing a substantial portion of herd feed needs and, in turn, the manure is recycled by fertilizing those crops (more like the traditional Midwest swine model where a crop farm also produced pork). Many Western dairies import excellent quality dry hay, have access to numerous food processing by-product feeds, and are supported by subsidized irrigation projects, all leading to a much higher animal density for a given manure application area. A broken nutrient cycling scenario results. While New York dairy farms also import more nutrients onto their farms than are exported through the sale of farm goods, the balance is far better than in many other states. This positions New York dairy farms to be key agents for smart growth. That is, development based on the pillars of sustainability: environmental stewardship, economic growth, and prosperous communities.

Agriculture's Contributions to Sustainable Development

Agriculture, especially the family-run dairy farms defined as CAFO farms, will continue to be a key component of the sustainable development equation in New York State for the following reasons:



Dréo, 2006

Environmental Stewardship

Agricultural Environmental Management
AEM

- Farmers raise livestock and grow crops on 25% of the State's land area (7.5 million acres). CAFO dairy farms in NYS cultivate over 1 million of those acres (National Agricultural Statistics Service in NYS). When performed with a strong environmental ethic, farming is a form of rural economic development which yields many additional benefits to New Yorkers, including locally produced foods, unpaved open space, wildlife habitat, storm water management, soil conservation, water and air quality, and local energy production. Such an environmental ethic is demonstrated daily by CAFO dairy farms following Comprehensive Nutrient Management Plans (CNMP) and other farms conserving resources through the Agricultural Environmental Management (AEM) Program.

- The cost of environmental management is not often covered in the price farmers receive for their products. Even with cost share assistance for conservation projects, New York's farmers make significant investments of their own to protect the environment. In addition to the costs of environmental management, the prices received by farmers have been highly volatile and on average flat, while farm input costs and family living expenses continue to rise. To bridge the gap and buffer price volatility, farms take many approaches, including expansion to spread capital costs over additional units of production and utilize economies of scale; direct marketing; value added production and processing; off-farm jobs; etc. Considering the array of consumer incomes and demands across New York State and the need to maintain a base of agricultural suppliers and processors, we need farms of all types to grow everything from accessible, inexpensive foods to higher-value foods. Depending on the approach taken, the farms will look different; but their potential to contribute to sustainable development is the same, regardless of size or shape, as it relies much more on farm management, than farm type.

Economic Growth

- Farms contribute billions of dollars to New York's economy, including over $3 billion in

Agricultural Environmental Management (AEM) Overview

- **The AEM umbrella** is a partnership for conservation and compliance assistance for all farms in New York State. It provides the following:
    - Coordinated policy and program development among a wide range of stakeholders;
        - Including farmer organizations, environmental organizations, Cornell University, Cornell Cooperative Extension (CCE), USDA Natural Resources Conservation Service (NRCS), county Soil and Water Conservation Districts (SWCD), and NYS Departments of Agriculture and Markets (NYS DA&M), Environmental Conservation (NYS DEC), Health (NYS DOH), and State (NYS DOS), etc.
    - Funding to farmers for conservation;
    - Modest funding for technical support to farmers by Soil and Water Conservation Districts and for applied research and extension work;
    - Education and outreach to farmers and planners – CAFO Roadshow, local CCE and SWCD workshops, Conservation Skills Workshop, Water Quality Symposium, Certified Crop Advisor Training, AEM Training, Professional Engineer Trainings, etc.;
    - AEM Planner training and certification;
        - Certified AEM Planners are professionals, certified through a rigorous, performance-based process for the life of their certification to develop and sign CNMPs according to NRCS standards and the NYS DEC CAFO general permit. Certification requires:
            - Certified Crop Advisor accreditation and code of ethics;
            - initial and on-going training;
            - 3 plan reviews by NYS DA&M staff to gain certification; and
            - on-going quality assurance reviews of their plans by NYS DA&M staff.
    - Technical assistance and tools for identifying, addressing, and evaluating conservation on all farms in New York State (CAFO regulated farms included);
    - Research-based responses to issues as they develop;
    - See also www.nys-soilandwater.org and the AEM Annual Report.
- **How AEM works at the farm level**
    - A county's SWCD staff, Certified AEM Planner, and/or other local conservation partners (henceforth referred to as "the team") progress through the 5 Tier AEM Conservation Planning Approach with a farmer.
        - **Tier I – Inventory:** the team discusses AEM with the farmer and gathers general farm information and interests through the Tier I inventory.
        - **Tier II – Assessment:** the team and farmer perform an in-depth assessment of the farmstead and fields with the AEM Tier II worksheets to document environmental stewardship, benchmark conditions, identify natural resource concerns, and educate.
        - **Tier III – Conservation Planning:** conservation practices (or best management practices – BMPs) are planned according to NRCS standards to address the resource concerns identified in the Tier II worksheets. For non-regulated farms, the plans can

focus solely on an individual practice *or* cover all resource concerns with a Comprehensive Nutrient Management Plan developed by a Certified AEM Planner. CAFO regulated farms are required to have a CNMP developed by a Certified AEM Planner. The planned practices can be included in proposals for State or federal cost share assistance through the local SWCD or NRCS staff, respectively.

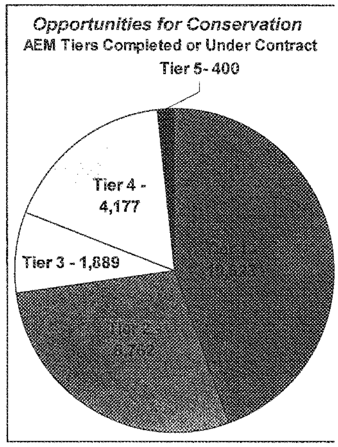
- CNMPs are research-based, farm-specific plans in which farmsteads and fields are thoroughly assessed and resource concerns are addressed with an integrated system of conservation practices according to NRCS standards. Practices often include structural items to collect and/or treat farmstead nutrient sources, such as manure storages, barnyards, and filter strips, as well as management practices designed to safely recycle the nutrients as fertilizer for crop production, such as careful timing and placement of nutrients applied to fields, conservation tillage, crop rotations and cover crops. CNMPs also include annual updates, operation and maintenance recommendations, records, and emergency action plans. CNMPs are developed by Certified AEM Planners.

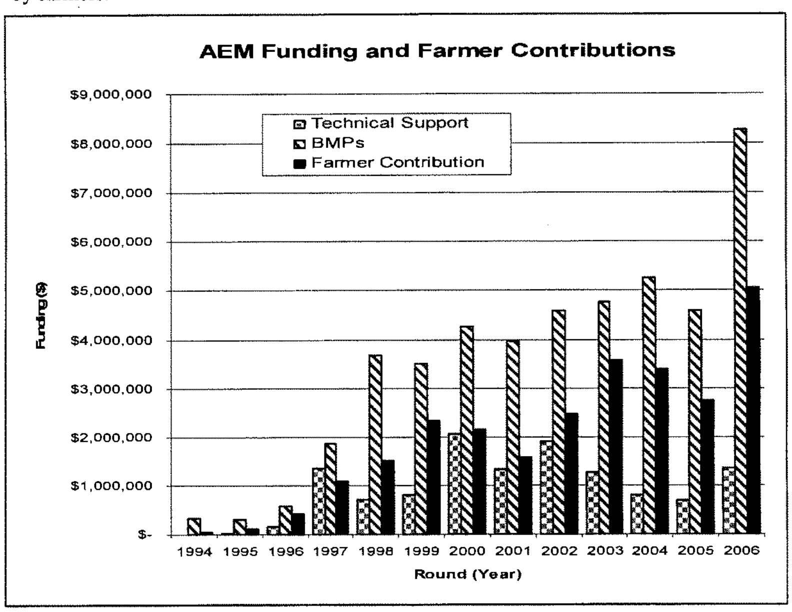
- **Tier IV – Implementation:** the team, including design professionals such as Professional Engineers, works with the farmer and contractor to implement the practices. They apply their technical skills to design, install, and inspect practices, as well as review operation and maintenance requirements with the farmer.

- **Tier V – Evaluation:** the team may evaluate the operation and maintenance of installed practices, revise the plan, recommend additional practices, and/or further offer education and technical assistance to the farmer. Tier V is also designed for evaluation of team performance and adequacy of the SWCD's strategic AEM plan for the county.

- Note, the basic AEM approach for CNMP development, implementation, and updates is the same for all livestock farms, CAFO or otherwise. While non-CAFO farms can implement according to their own schedule, CAFO regulated farms must manage their CNMPs according to the specific requirements of the NYS DEC CAFO permit (e.g. deadlines, record keeping, reporting, inspections, etc.).

- **AEM Performance**
  - Approximately 10,000 out of a total of 35,600 farms in NYS are enrolled in AEM to date.
    - 1,977 conservation practices have been completed.
    - 2,200 conservation practices are under contract.
  - Over $60 million has been allocated for conservation practices over 13 rounds of funding since 1994.
    - $7.5 million for plan development.
    - $12 million in technical support funding to help planning teams implement practices.
    - $42 million for practice installations.
  - Plus $24 million in cash and in-kind investment by farmers.





  - Education and outreach
    - 43 AEM Planners have been trained, reviewed, and certified.

  - 1000's of farmers have taken advantage of 100's of AEM partner workshops.
  - 100's of planners continue to stay current through AEM partner workshops.
  - 1000's of individualized support and compliance assistance interactions through farm visits, phone calls, and email.
  - Collaborative development/refinement of guidelines and tools for conservation, including AEM worksheets, Cornell Cropware, NRCS standards, groundwater protection guidelines, etc.

NYS Concentrated Animal Feeding Operation (CAFO) General Permit Basics

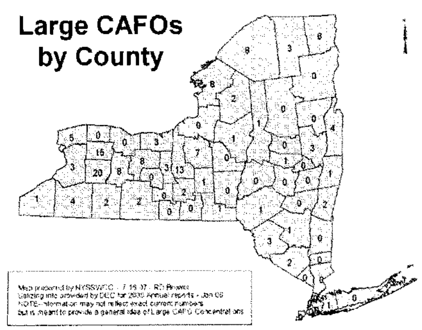
- Original NYS DEC CAFO general permit issued in 1999 and renewed in 2004: one of the first in the U.S., requested by both agricultural and environmental interests in NYS.
- NYS DEC's CAFO Workgroup and NYS DA&M's AEM Certification Subcommittee are utilized for stakeholder coordination and involvement in technical advising, oversight, policy discussion, trainings, etc.
- General permit requires each permitted farm to have a CNMP developed by a Certified AEM Planner and manage according to the CNMP.
  - The CNMPs include practices for the farmstead areas and fields in order to maintain no discharge of process wastewater from facilities unless due to rainfall events which cause an overflow from a facility designed, constructed and operated to contain all process generated waste waters plus runoff from a 25-year, 24-hour storm.
- NYS DA&M provides State oversight of planners and their development of CNMPs through the Certified AEM Planner Program and NYS DEC provides State oversight of CNMP implementation by the farm through the on-farm compliance inspections and reporting requirements of the CAFO general permit. Together, these programs provide State oversight from plan development through implementation.
- **General CAFO permit versus individual permits.** Both the AEM Program and CAFO Permitting Program must maintain public trust, stimulate agricultural business development, and protect natural resources. Both programs continue to satisfy these goals. The 2009 CAFO general permit renewal offers opportunities to provide more clarity to farmers about what it means to comply; additional public access to CNMPs through an enhanced annual report/plan template; continued use of Certified AEM Planners; and an option for an environmentally sound and cost effective alternative New York State program for medium AFO farms.
  - Continued use of a statewide general permit is strongly recommended for the following reasons (largely from J. DiMura in *Clearwaters* 2005, www.nywea.org/Clearwaters/05-spring/permitting.pdf):
    - Nearly a decade of experience with the current CAFO general permit has proven that the general permit approach is effective in realizing compliance and environmental protection.
    - A general permit provides statewide standards and consistency in environmental protection while allowing for site specific management practices in each farm's CNMP. The approach maintains effectiveness by improving efficiency (and clarity)

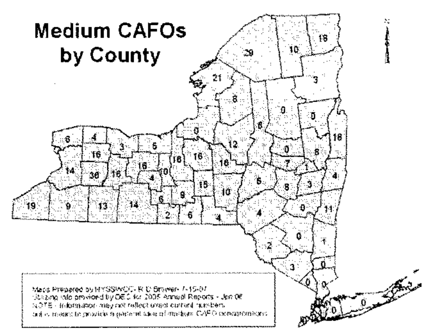
in outreach to farmers, compliance inspections and determinations, reporting, administrative costs for the regulatory agency and support costs for agricultural agencies.

- Based on cost estimates for a more individualized permitting approach as described in EPA's proposed rule in response to *Waterkeeper*, the current general permit approach would save farmers $1.1 million and taxpayers $3.6 million in unnecessary administrative costs annually in NYS (NYS DA&M comments to EPA, August 2006).
- CAFO farms represent a low environmental risk category relative to most other permitted facilities such as factories, waste water treatment plants, power plants, etc. and do not warrant individual permits.
- CAFO farms exhibit many similar characteristics.
- Permitting occurs in a timely fashion so as to avoid excessive burden on farm businesses.

Progressive environmental management by NY farmers regulated by CAFO

- Currently 147 farms are permitted as large CAFO farms and 465 farms are permitted as medium CAFO farms. Family-run dairy farms comprise the vast majority in both categories.





- **Deadline for full implementation by large CAFO farms**: 12/31/06 (7/31/07)
  - o All large CAFO farms have completed CNMPs and 91 are expected to fully implement their CNMPs by the 7/31/07 deadline.
- **Deadlines for medium CAFO farms**: 10/1/07 for non-structural practices, 10/1/08 for practices addressing high risk areas, and 6/30/09 for full implementation.
  - o 429 medium CAFO farms have completed CNMPs, 28 are fully implemented ahead of time, and 372 expect to be fully implemented by 6/30/09.

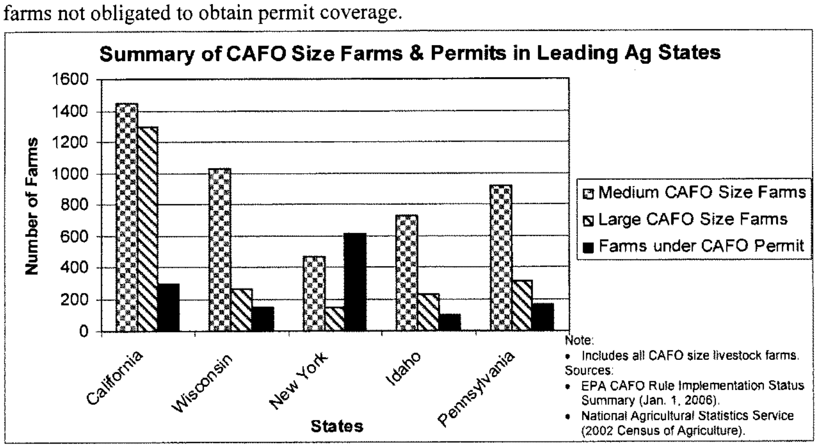
- **Investment by farmers**
  - Farmers spend, on average, $10,000 for CNMP development and $5,000 for annual updates.
  - Farmers then often spend hundreds of thousands to implement and maintain conservation practices according to their CNMP. USDA NRCS estimates capital costs at $100,000 to $500,000 per CAFO farm ("Agriculture Needs Survey" of 2005). While some cost-share assistance has been provided for planning and implementation, farmers incur significant out-of-pocket costs.
- **Farmers' environmental ethic continues to advance**
  - Dairy farm owners and managers estimate that a very substantial amount of their time, 30-50%, is devoted to ensuring proper environmental management according to their CNMP, which is only one component of overall farm management.
  - Dairy farms in New York reinforced their long track-record of proactive involvement in environmental initiatives by exceeding any other state, including California, in enrollment for the EPA's Air Quality Compliance Agreement.
  - The Environmental Stewardship Committee of the Center for Dairy Excellence strongly supports AEM and wants to see more environmental practices applied on farms of all sizes.
  - Proactive participation by dairy farmers in the development of the AEM Program and CAFO permit since their inception in the 1990s.
  - The amount of fertilizer P used on farms decreased from 56.6 million lbs of P in 1992, to 35.1 million lbs in 1997 and 28.1 million lbs in 2002 (Statewide P Study, Ketterings, 2006). CAFO farms are a significant part of this progress, more efficiently using manure for soil fertility and crop production.
  - The Whole Farm Nutrient Management Class is a capstone course in the Cornell University Dairy Management curriculum: each year ~35 students polish their environmental ethic just before graduating to work in dairy farming (largely in NYS) having developed a nutrient management plan for the land base and strategies to manage cattle diets to reduce nutrient imports and excretion.
- **Model, Progressive Dairy Farms**
  - Key elements of a progressive dairy farm:
    - Profitable, with a long term interest in sustaining the farm business in the community;
    - Land base is adequate for recycling manure nutrients for crop production in an environmentally sound manner;
      - Follows a Comprehensive Nutrient Management Plan;
    - Seeks management and practices which provide other environmental benefits (e.g. air quality, carbon conservation, renewable energy, etc.), such as anaerobic digestion for energy production and methane destruction;
    - Constantly evaluating performance, innovating and striving for improvement;
    - Actively involved in applied research, extension, and/or policy development;
    - Proactive with changing science, technology, and public policy;

- Valued member of the community.

- Many dairy farms in New York State exemplify these elements, thanks to progressive dairy farm leaders and the AEM partnership. Please consider an invitation to tour such farms, to see the dedication to rural economic development, community, and environmental protection first hand.

How NYS Ranks on CAFO

- NYS began its CAFO permit coverage in 1999 (2003 is the average date of permit coverage among U.S. states).
- NYS has 100% of its known CAFO farms covered by its permit (45% of known CAFOs are covered by a permit on average across U.S. states).
- While most states have medium CAFO language in their permits (200-699 cows + discharge), most regulation is focused on large CAFOs ($\geq$700 cows). Under the EPA's 2006 proposed revisions to the 2003 CAFO Rule in response to the *Waterkeeper* decision, a farm has "no duty to apply" for a CAFO permit for a potential to discharge, but rather only if the farm discharges or proposes to discharge. EPA's 2003 CAFO Rule required all large CAFOs to obtain permits unless they could show no "potential to discharge." (The 2003 Rule was clear, however, that medium CAFOs only required a permit if they in fact discharged.) When NYS adopted its CAFO general permit in 1999, however, medium CAFOs were required to obtain a permit if they discharged or had a "potential to discharge" (the "potential to discharge" criteria for medium CAFOs was subsequently removed when the permit was renewed in 2004). The conflicting and shifting federal and State requirements led many farms in NYS to enter into the permit to be safe. Other states either chose inaction, citing confusion about CAFO regulations at the federal level, and ignored farms needing permits or developed state programs to offer non-permit options. The AEM program offers a very effective alternative program, in terms of environmental benefits and tax-payer costs, for farms not obligated to obtain permit coverage.



- Departments of Agriculture have an active role in CAFO regulation in 16 states, including programs which aim to provide compliance assistance and support farms in environmental management. The programs in New York and Michigan stand out as the premier state programs. Additional examples from major agricultural states are also provided, below.
  - New York's Agricultural Environmental Management (AEM) Program (www.nys-soilandwater.org)
  - The Michigan Agricultural Environmental Assurance Program (MAEAP) (www.maeap.org)
  - Maryland's Nutrient Management Program (www.mda.state.md.us/resource_conservation/nutrient_management/index.php)
  - Pennsylvania's Nutrient Management Program (http://panutrientmgmt.cas.psu.edu/)
  - California's Dairy Quality Assurance Program (www.cdqa.org), but only 121 dairy farms have been certified relative to their 1000 farm goal and the mechanisms for addressing environmental issues appear less than adequate. California also only recently adopted a State water quality program for dairy farms in 2007; many years after NYS.
  - Washington State's Livestock Nutrient Management Program (http://agr.wa.gov/FoodAnimal/Livestock-Nutrient/LivestockNutrient.htm)
- NYS has the most rigorous certified planner requirements and the only planner quality assurance program (43 planners currently certified).
  - Only 17 other states have a certified preparer requirement.
  - The Certified AEM Planner program was commended by environmental groups in comments to EPA regarding policy changes due to *Waterkeeper*.

Opportunities

Building AEM (and CAFO) capacity, partnerships, and impact

- Long-term, result-driven AEM base-funding program for local partners (SWCDs, Extension, etc.).
  - Increased funding for farmers requires long-term funding commitments to technical support staff (specialists, technicians, engineers, etc.) at the county- and state-wide levels.
- Pursue rule changes to the Environmental Protection Fund to allow investments in skilled staff, applied research, and extension outreach, to support conservation practice implementation.
  - Farms will continue to advance through the AEM Tiers and many more farms will enter the AEM Program if the technical support capacity is increased to better complement funding for practice implementation. More AEM equals more environmental protection.
- Developing and delivering solutions for complex problems requires increased support for our university and college partners to perform applied research and extension outreach through educational programs and on-farm demonstration.

- Must continue to build and support environmental ethic throughout the farm community, on farms of all types and sizes.
- Revise 2009 CAFO general permit during the renewal process to clarify compliance and enforcement strategies for CAFO permitted farms.
- Develop an environmentally sound and cost effective alternative New York State program for medium AFO farms.

APHA

American Public Health Association
Working for a Healthier World
800 I Street, NW • Washington, DC 20001-3710
(202) 777-APHA • Fax: (202) 777-2534 • comments@apha.org • www.apha.org

August 30, 2007

The Honorable Barbara Boxer
Chairman
U.S. Senate Committee on Environment and Public Works
410 Dirksen Senate Office Bldg.
Washington, DC 20510-6175

Dear Chairman Boxer:

The American Public Health Association (APHA) is the oldest, largest and most diverse organization of public health professionals in the world, dedicated to protecting all Americans and their communities from preventable, serious health threats and assuring community-based health promotion and disease prevention activities and preventive health services are universally accessible in the United States. I write on behalf of APHA to express our concerns regarding Concentrated Animal Feed Operations (CAFOs) and our opposition to potential efforts to exempt certain wastes from regulation under federal hazardous waste laws.

In 2003, APHA adopted a resolution calling for a moratorium on CAFOs. We believe the negative health impacts these facilities have on our air, water and soil constitute the need for a moratorium on until additional scientific data on the risks to public health have been collected and uncertainties resolved.

CAFO generated animal wastes often contain heavy metals, antibiotics, pathogen bacteria, nitrogen, phosphorus as well as dust and mold. This waste is often spread, untreated on nearby cropland. Runoff from this practice can carry human pathogens and other toxics into surface waters that serve as drinking water sources.

Access to safe drinking water and clean air are key element to ensuring the health of the public. Efforts that would remove animal wastes as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act, thus limiting important pollution reporting data and the efforts of communities to recover the costs of cleaning up water sources contaminated by CAFOs, run counter to public health practice and policy making. In order to ensure the safest drinking water and cleanest air for the American public, we urge you to oppose efforts to eliminate important pollution reporting requirements and cleanup liability protections.

Sincerely,

Georges C. Benjamin, MD, FACP, FACEP (Emeritus)
Executive Director

cc: The Honorable Tom Harkin

ASSOCIATION OF
METROPOLITAN
WATER AGENCIES

June 25, 2007

Subject: Reject CERCLA Animal Waste Exemption

Dear Members of the Senate:

Once again, efforts are underway in Congress to eliminate existing authorities from the Superfund statute that have been used by community water systems to protect local watersheds and the very sources of drinking water for communities, towns, and cities. The 109th Congress declined to adopt such legislation last year, and we strongly urge Congress to reject it again.

During Senate consideration of H.R. 6, the CLEAN Energy Act of 2007, an amendment was offered to provide blanket exemptions from the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) for animal wastes. While consideration of the amendment was blocked, the measure has been introduced as a stand-alone bill (S. 807), and we understand there is a possibility it may also be offered as an amendment to the Farm Bill later this year.

The measure would preclude manure from being considered a "hazardous substance" under Section 101(14) and from the definition of a "pollutant or contaminant" under Section 101(33) of CERCLA.

This change is unnecessary and unwise for several reasons. Manure is NOT considered a hazardous substance, pollutant or contaminant under CERCLA. Further, CERCLA already has an exemption for the normal application of fertilizer that would include manure.

However, phosphorus IS a hazardous substance under CERLCA, is a constituent present in manure, and it pollutes the drinking water sources that are downstream from animal feeding operations. Enactment of this measure would result in the increased discharge of phosphorus and other CERCLA-regulated contaminants into water supplies, compromising the quality of communities' drinking water. Furthermore, if a broad exemption for manure were to be added to CERCLA, communities would be precluded from cost recovery for pollution beyond the normal application of fertilizer currently permitted under CERCLA. This would unfairly shift the burden of clean up from the polluter to local ratepayers.

We strongly urge that this bill not be enacted nor the provisions of the bill be incorporated into any other legislation in either the House or Senate.

The American Water Works Association (AWWA) is the nation's oldest and largest organization of drinking water professionals. Our utility members provide safe and affordable water to more than 80 percent of the American people.

The Association of Metropolitan Water Agencies (AMWA) is an organization of the largest publicly owned drinking water systems in the United States. Our membership serves more than 127 million Americans with drinking water from Alaska to Puerto Rico.

If you need more information, please don't hesitate to contact us at 202-628-8303 (AWWA) or 202-331-2820 (AMWA).

Sincerely,

Tom Curtis
Deputy Executive Director
American Water Works Association

Diane VanDe Hei
Executive Director
Association of Metropolitan Water Agencies

Jun-06-06 09:28 From-AMWA 2027851845 T-375 P.001/001 F-168

Des Moines Water Works **Comment Document** June 5, 2006	Source Water Contamination from Animal Waste

ATTENTION:

Des Moines Water Works (DMWW), wants your support to oppose legislation that would exempt the by products and constituents of animal waste from the Comprehensive Environmental Response Compensation Liability Act (CERCLA).

This legislation would prevent community drinking water providers from recovering the costs of removing or reducing high levels of contaminants, such as phosphorus, from large upstream animal feeding operations.

CERCLA is the only federal statute that allows state and local governments and drinking water utilities to recover cleanup or water treatment costs from parties responsible for contamination of local drinking water supplies. By exempting the noncompliant, excessive and abnormal (beyond beneficial use) application of animal waste as fertilizer under CERCLA, local communities would be precluded from cost recovery.

Nonpoint source pollution of drinking water supplies is a significant problem, and communities have been burdened with the high cost of treating the polluted water. For example DMWW has the largest nitrate removal facility in the world. The cost to operate this facility is $3,000 day. On average the facility operates 45-60 days annually. Another example is Waco, Texas. According to testimony last year, local citizens of Waco have had to absorb $3.5 million through their rates for the purpose of treating water contaminated by large-scale dairy operations.

Changing the CERCLA definition would also preclude federal or state cleanup efforts, forcing the treatment burden – and thus the treatment cost – onto community water systems and local consumers.

We strongly urge you to oppose any liability waivers under CERCLA for animal waste.

Thank you for your consideration.

Sincerely,

Linda Kinman

Linda Kinman
On behalf of

L.D. McMullen, Ph.D., P.E.
CEO and General Manager

Farmers for Clean Air & Water, Inc.

50 F St, NW, #900
Washington, D.C. 20001

September 12, 2007

The Honorable Barbara Boxer Chairman Committee on Environment & Public Works U.S. Senate Washington, D.C. 20510	The Honorable James Inhofe Ranking Member Committee on Environment & Public Works U.S. Senate Washington, D.C. 20510

RE: Statement for the Record of the Hearing Titled, "An Examination of the Potential Human Health, Water Quality, and Other Impacts of the Confined Animal Feeding Operation Industry"

Dear Chairman Boxer and Ranking Member Inhofe:

As a broad coalition of national and state farm organizations across the country, Farmers for Clean Air & Water (FCAW) and its more than two-dozen member organizations are submitting this statement for the record in relation to the U.S. Senate Environment and Public Works Committee's hearing on September 6, 2007 on issues related to concentrated animal feed operations (CAFOs) and the effects on human health and water resources.

Our Coalition is dedicated to policies protecting our land, air and water by promoting the existing environmental controls of the states and the federal government, enhancing collaboration on other practices that improve management of nutrients from animal byproducts and holding the line against a punitive extension of CERCLA by activist litigators through the Courts that would designate manure a hazardous substance. While we applaud the Committee's attention to the application of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to animal agriculture, we were disappointed that the hearing failed to address a number of significant points related to the application of CERCLA to animal manure. As such, we appreciate this opportunity to discuss some troubling errors and omissions in the hearing related to this pivotal issue. Our statement will address:

- The way in which Superfund actually works relative to substances deemed hazardous regardless of how they are applied.
- The severe impact on agriculture, conservation management, organic production and alternative energy applications that could result should punitive Superfund liability be extended to manure.
- The existing federal and state laws and regulations controlling harmful release of animal byproduct and punishment for bad actors.
- The existing exclusion from CERCLA liability of petroleum and the significant frequency and volumes of raw human sewage directly released into our nation's waterways by municipal wastewater systems.

<u>CERCLA Overview - intent, liability and breadth of application to market participants</u>

Our coalition does not believe that CERCLA as drafted was ever intended to apply to animal manure or waste. As the Committee well knows, the main purpose of CERCLA was to address some of the nation's most contaminated sites, such as Love Canal. The focus in the law was on the release of truly toxic substance into the air and water. Organic substances like manure were not considered and in fact,

Farmers for Clean Air & Water is a broad coalition of farm organizations across the country, including the American Farm Bureau Federation, American Meat Institute, CoBank, Dairy Farmers of America, Farm Credit Council, Fertilizer Institute, American Horse Council, National Association of State Departments of Agriculture, National Cattlemen's Beef Association, National Chicken Council, National Corn Growers Association, National Council of Farmer Cooperatives, National Milk Producers Federation, National Pork Producers Council, National Turkey Federation, Select Milk Producers, state farm organizations and individual producers.

chemically based fertilizers were explicitly exempted from its provisions. Despite what some claim, the nitrogen and phosphorus compounds contained in animal manure are not on the Environmental Protection Agency's list of hazardous substances and are not intended to be actionable under CERCLA. As the Committee also knows, CERCLA was not drafted as a regulatory scheme or with fairness in mind; rather, it was drafted as a blunt tool to address some of the nation's worst toxic sites, generally abandoned industrial sites and chemical landfills. It was crafted to extend extreme liability in order to address releases of the most toxic of pollutants. CERCLA liability is:

Strict – CERCLA liability applies without regard to fault or wrongdoing. Compliance with the law or good intentions are generally not defenses.
Joint and Several – CERCLA liability generally can be imposed 100% on any one contributor to the pollution, even if that contributor was a relatively a small part of the problem.
Retroactive – CERCLA liability applies to activities that occurred before the statute was enacted. In fact, it has no cut-off date.

In addition, CERCLA has broad applicability to many different types of parties:

Owner/Operators – Anyone who owns or operates a site where hazardous substances have been released into the environment can be held liable.
Generators – Anyone responsible for generating (arranging for disposal) of hazardous substances that are subsequently released into the environment can be held liable.
Transporters – Anyone who hauls hazardous substances that are subsequently released into the environment can be held liable.

Therefore, CERCLA hazardous substances require tremendous care such as transport by designated hazmat trucks and drivers and disposal in deemed hazardous waste landfills. All of these would be economically impractical and not practically feasible "solutions" to disposal of animal byproduct. Most important, the clear focus of CERCLA as enacted was to assign liability for the cleanup of sites, often abandoned, that were rendered toxic by the release of specific hazardous substances. Animal agriculture, supported by clear facts, rejects the notion that either animal manure or its constituents represent hazardous substances under CERCLA and that farms and ranches should ever be considered Superfund sites.

CERCLA – Analyzing the consequences of a hazardous substance designation to manure *on responsible agriculture practices*

For the reasons outlined in the previous section, should Congress fail to take action to clarify the intent of CERCLA, and leave this matter to the courts, a ruling that manure is or contains hazardous substances that triggers CERCLA liability could capture many routine farming activities in CERCLA's liability web:

• Farmers who use manure as a fertilizer on fields they either own or farm may be held liable under CERCLA as "owners" or "operators" for the legal use of manure on those fields.
• Farmers who sell, trade, or barter manure to other farmers for use as a fertilizer may be liable as "generators" of a hazardous waste.
• Farmers may be held liable as "generators" where their livestock directly introduces manure into the environment while foraging on rangeland or in feedlots.
• Farmers, hauling firms, or others may be held liable as "transporters" for hauling manure from one location to another.
• Farmer and other landowners may be held liable as "owners" or "operators" for past manure use on their land, even use that occurred before they purchased the land.

Congress should clarify that it never intended to jeopardize American agriculture by imposing strict, joint, several, and retroactive CERCLA liability on farmers for their traditional farming

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practices, including the use of manure as a beneficial fertilizer. Most notably, farming practices like those above are conducted on all commercial and noncommercial agriculture operations regardless of the size of production.

Environmental Management and Organic Food Production

A sad irony is that while the overwhelming majority of US agriculture supports best practices and extension of education and resources to continually improve their environmental practices, those proclaiming to support the extension of CERCLA to manure will directly undermine the ability of farmers and ranchers in nutrient rich areas to properly utilize their nutrients. Not only would the designation of manure greatly disrupt the legitimate practice of applying manure to the land as fertilizer, it would shut down other promising avenues, likely forcing producers to simply put the manure into landfills. Further, the impacts on the expanding multi-billion US organic food production industry cannot be overlooked as it was in this hearing. A witness from that industry in a hearing in the US House of Representatives earlier this year stated that the application of CERCLA to manure would effectively end organic food production in the U.S. since organic row crop production is predicated in the use of animal manure for fertilization. Needless to say, that would be another major competitive blow to the U.S. economy.

Promise from Alternative ENERGY applications

A very promising development for agriculture concerns emerging technologies that will increasingly allow farmers and ranchers to convert excess animal manure to renewable energy. The Congress has already enacted number of policy initiatives – including research and development programs, tax incentives, and grants and loans to encourage the conversion of animal waste to energy. These developments are not only good for agriculture, but important to the nation's goal of diversifying its energy portfolio and becoming less dependent on foreign oil and natural gas. Unfortunately, as articulated by Professor Dicks at last week's hearing, the application of CERCLA to animal manure would effectively shut down these types of alternative uses for manure. Due to the severe nature of CERCLA liability, as previously discussed, farmers and ranchers will not assume additional risk of storing, hauling or transferring manure for energy generation if manure or its constituents are deemed hazardous substances. CERCLA liability, even the uncertainty around livestock and poultry manure due to inappropriate lawsuits, threatens to undermine our federal policy objectives and taxpayer backed incentives to help promote renewable energy production from these sources. Misapplication of this punitive regulatory structure further threatens to erode the commercial and financial market investment needed to implement these promising renewable energy innovations. It is worth noting that this very same CERCLA structure already specifically excludes from its punitive liability schemes the fossil fuel feedstock petroleum including its clearly lethal constituents. While petroleum is certainly covered under different laws, it was recognized at the time of enactment that CERCLA was too crude an instrument to apply to petroleum.

Existing Environmental Controls

Proponents of extending CERCLA liability to animal manure would like to divert attention and confuse the issue by proclaiming that existing environmental safeguards are being "rolled back" through this effort to clarify CERCLA. Participants in the hearing made such assertions and also tried to divide American agriculture by falsely claiming that only large farming operations would be affected by CERCLA, or alleging that farmers are unregulated polluters. Nothing could be further from the truth. American farmers and ranchers are regulated under varying degrees by the federal Clean Water Act, Clean Air Act, Safe Drinking Water Act and other federal and state environmental laws, regulations and required permitting. Bad actors have been aggressively pursued, forced to clean-up farms, prosecuted and penalized with multi-million dollar fines under the authorities of these acts for illegal releases of animal waste in different jurisdictions around the country. To Date, CERCLA has not been seen as an appropriate or effective tool to deal with problems on the farm, which is why recent court cases are of such concern.

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Water Resource Protection & Municipal Wastewater Operations – Inconsistent Standards & Hypocrisy of Raw Human Sewage Releases

According to the U.S. Environmental Protection Agency, aging municipal sewer systems pour more than one trillion gallons of untreated sewage into the nation's waterways each year, making them almost certainly the largest single source of water pollution and a major threat to human health. But instead of recognizing this fact during the hearing and the clear need for all of us to address human growth demands, consolidation and pressures to upgrade sewage facilities to protect our rivers, streams and lakes, a panelist representing local water authorities directed his attention toward animal agriculture and promoting the extension of CERCLA liability. Many water authorities have forged an unlikely alliance, given their record of contributing to water pollution, with environmental organizations and trial lawyers looking to misapply the liability provisions of the Superfund laws to farmers and ranchers. This despite the fact thatthe Washington Post reported September 29, 2006, that human and industrial waste from broken septic systems and sewage overflows during heavy rains are responsible for more contamination and bacteria in the Potomac River than any runoff from livestock manure. In addition, one recent study showed that nationwide over an 18-month period, 62 percent of sewage facilities exceeded the levels of waste pollution allowed by their permits – amounting to more than 29,000 illegal releases. Publicly-Owned Treatment Works (POTWs) are largely exempt from the Superfund laws. It is hypocritical and counterproductive for organizations like the National Association of Counties, American Water Works Association and the Association of Metropolitan Water Agencies to be pushing for farmers to be brought under the Superfund laws while their own malfunctioning or inadequate sewage facilities remain a larger source of pollution to many of our nation's waterways. Whatever the motivation behind this hypocrisy, it would be far better for agriculture and water authorities to work together on specific water quality challenges.

Conclusion

Rather than focusing on ways to collaborate and address water resource challenges, last week's hearing unfortunately focused mostly on vilifying an entire segment of the U.S. economy by ignoring existing legal controls over agricultural operations and supporting the misapplication of extreme CERCLA liability to manure in all its applications. Unfortunately, the consequences of extending this liability to animal manure were not examined but as we have outlined are severe and include: undermining progress through existing environmental stewardship practices being implemented on CAFOs and other agricultural operations; jeopardizing the future economic competitiveness of the agricultural segment of our economy (including all organic production): hampering the promising development of alternative technologies to offset fossil fuel consumption; and failing to recognize that water quality problems require comprehensive solutions that recognize the role of not only farmers and ranchers, but the many other contributors in a given area.

Unless the intention of proponents is to eliminate agriculture entirely from practice in a given watershed, CERCLA is too blunt an instrument to deal with a "living" industry operating on the land and to pursue liability against all the many handlers of such a commonly used organic compound like manure.. That is why it was never contemplated as such when the law was written. The solution is adopting bipartisan legislation (S 807) that brings clarity to the debate by making clear that manure should not be penalized under the Superfund laws. Support for it by the Committee and the Congress would protect against all of these damaging consequences and permit a cooperative discussion as to how to enhance the regulatory and incentive based policies to continue to harness U.S. agriculture as the leading stewards of our land, water and air.

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Alliance for the Great Lakes • American Bottom Conservancy • American Rivers • Animal Welfare Institute • Appalachian Center for the Economy and the Environment • Arizona PIRG • Center on Race, Poverty & the Environment • Christen Farms • Citizens Against Factory Farms, Inc • Clean Water Action • Clean Water Action Alliance of Minnesota • Clean Water Network of Florida • Coast Action Group • Community Association for Restoration of the Environment • Concerned Residents Against Pig Confinements • Dakota Rural Action • Earthjustice • Environmental Law and Policy Center • Environment Colorado • Environment Michigan • Families Against Rural Messes • Family Farm Defenders • Family Farms for the Future • Friends of Milwaukee's Rivers • Great Lakes Aquatic Habitat Network and Fund • Gulf Restoration Network • Help Save the Apalachicola River Group • Idaho Conservation League • Illinois Stewardship Alliance • Indigenous Environmental Network • Iowa CCI • Iowa Environmental Council • Iowa Farmers Union • Lower Susquehanna Riverkeeper • Michigan Environmental Council • Michigan Land Use Institute • Michigan Nature Association • Midwest Environmental Advocates • Milwaukee Riverkeeper • The Minnesota Project • Missouri Coalition for the Environment • New Jersey State Federation of Sportsmen's Clubs • National Lawyers Guild Environmental Justice Committee • Natural Resources Defense Council • The New York Environmental Law & Justice Project • Northwest Environmental Defense Center • The Ohio Environmental Council • Ozark Clear Water • Raymond Proffitt Foundation • Save the Valley • Sierra Club • Sustainable Agriculture Coalition • Tip of the Mitt Watershed Council • United States Public Interest Research Group • Waterkeeper Alliance • Western Environmental Law Center • Western Organization of Resource Councils • West Virginia B.A.S.S. Federation Nation • Wyoming Outdoor Council

OPPOSE LEGISLATION TO EXEMPT LIVESTOCK MANURE FROM CERCLA

August 4, 2006

Dear Member of Congress:

The Clean Water Network, an alliance of more than 1,000 public interest groups working to strengthen federal clean water policy, opposes H.R. 4341 and S. 3681, which would exempt contamination from livestock manure from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Proponents of this legislation argue that CERCLA is redundant because the Clean Water Act strictly regulates pollution from livestock operations. However, both laws are essential to protect people's health and the environment from livestock waste. CERCLA and the Clean Water Act serve different purposes but are complementary. While the Clean Water Act seeks to limit pollution from Concentrated Animal Feeding Operations (CAFOs), CERCLA focuses on remediation. CERCLA is the only federal statute that allows for State and local governments to recover cleanup costs from parties responsible

Mike Shriberg
Director
Environment Michigan
Ann Arbor, MI

Karen Hudson
President
Families Against Rural Messes
Elmwood, IL

John Peck
Executive Director
Family Farm Defenders
Madison, WI

Terry Spence
President
Family Farms for the Future
Unionville, MO

Lynn Broaddus
Executive Director
Friends of Milwaukee's Rivers
Milwaukee, WI

Emily Hartz
Program Associate
Great Lakes Aquatic Habitat Network
and Fund
Petoskey, MI

Cynthia Sarthou
Executive Director
Gulf Restoration Network
New Orleans, LA

Marilyn Blackwell
President
Help Save the Apalachicola River Group
Wewahitchka, FL

Courtney E. Washburn
Community Conservation Associate
Idaho Conservation League
Boise, ID

Gayle Keiser
Executive Director
Illinois Stewardship Alliance
Rochester, IL

Bob Shimek
Special Projects
Indigenous Environmental Network
Bemidji, MN

Carissa Lenfert
Rural Organizer
Iowa CCI
Des Moines, IA

Richard Leopold
Executive Director
Iowa Environmental Council
Des Moines, IA

Chris Petersen
President
Iowa Farmers Union
Ames, IA

James Clift
Policy Director
Michigan Environmental Council
Lansing, MI

Patty Cantrell
Entrepeneurial Agriculture Director
Michigan Land Use Institute
Beulah, MI

Jeremy P. Emmi
Executive Director
Michigan Nature Association
Williamston, MI

Andrew Hanson
Attorney
Midwest Environmental Advocates
Madison, WI

Cheryl Nenn
Milwaukee Riverkeeper
Milwaukee, WI

Loni Kemp
Senior Policy Analyst
The Minnesota Project
Canton, MN

Kim Knowles
Water Policy Analyst
Missouri Coalition for the Environment
St. Louis, MO

George P. Howard
Conservation Director
New Jersey State Federation of
Sportsmen's Clubs
Pittstown, NJ

Jeff Thomson
Co-Chair
National Lawyers Guild Environmental
Justice Committee
New York, NY

Jon Devine
Senior Attorney
Natural Resources Defense Council
Washington, DC

Joel Kupferman
Executive Director
The New York Environmental Law &
Justice Project
New York, NY

Mark Riskedahl
Executive Director
Northwest Environmental Defense
Center
Portland, OR

Vicki Deisner
Executive Director
Ohio Environmental Council
Columbus, OH

Mark Adams
Core Member
Ozark Clear Water
Neosho, MO

John C. O'Herron, II
President
Raymond Proffitt Foundation
Langhorne, PA

Richard Hill
President
Save the Valley
Madison, IN

Ed Hopkins
Director of Environmental Quality
Program
Sierra Club
Washington, DC

Vivian C. Leven
Research Associate
Society for Animal Protection Policy
Animal Welfare Institute
Washington, DC

Michael Helfrich
Lower Susquehanna Riverkeeper
Stewards of the Lower Susquehanna
York, PA

Martha Noble
Senior Policy Analyst
Sustainable Agriculture Coalition
Washington, DC

Grenetta Thomassey, PhD
Policy Director
Tip of the Mitt Watershed Council
Petoskey, MI

Christy Leavitt
Clean Water Advocate
United States Public Interest Research
Group
Washington, DC

Steve Jones
Director of Air and Water Quality
Wyoming Outdoor Council
Lander, WY

Jeff Odefey
Staff Attorney
Waterkeeper Alliance
Irvington, NY

Greg Costello
Executive Director
Western Environmental Law Center
Eugene, OR

Don Nelson
Chairman
Western Organization of Resources
Councils
Billings, MT

Jim Summers
Conservation Director
West Virginia B.A.S.S. Federation
Nation
Worthington, WV

Earthjustice · Environmental Integrity Project · Environmental Working Group · Food and Water Watch · Institute for Agriculture and Trade Policy · Izaak Walton League of America · The Humane Society of the United States · National Environmental Trust · Natural Resources Defense Council · Sierra Club · Sustainable Agriculture Coalition · Union of Concerned Scientists · U.S. PIRG · Waterkeeper Alliance · Western Organization of Resource Councils

PROTECT DRINKING WATER AND AIR FROM HAZARDOUS SUBSTANCES IN FACTORY FARM WASTE

The Honorable Tom Harkin
Chair, Senate Agriculture Committee
731 Hart Building
Washington DC 20510

The Honorable Saxby Chambliss
Ranking Member, Senate Agriculture Committee
416 Russell Building
Washington DC 20510

September 5, 2007

Dear Chairman Harkin and Ranking Member Chambliss:

When your committee takes up the Farm Bill, we understand that there may be an effort to exempt hazardous substances associated with excess amounts of livestock waste, such as phosphorus, ammonia and hydrogen sulfide, from key definitions under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Emergency Planning and Community Right to Know Act (EPCRA). We urge you to oppose these unwarranted exemptions, which will result in increased threats to drinking water supplies, force water users to bear the costs imposed by sloppy operations and withhold important information about air toxics from emergency responders and neighboring communities.

Representatives of some large-scale agriculture operations have argued to members of Congress and to farming communities that such an amendment is urgently needed to protect family farms from frivolous lawsuits and allow farmers to continue to use manure as fertilizer for crop production. These assertions are not based in fact: CERCLA's cost recovery and reporting requirements do not threaten responsible operators who manage manure as a valuable fertilizer. Farm lobby groups have spread a great deal of misinformation about how these laws affect agricultural operations, and we hope that the Environment and Public Works Committee, which has jurisdiction over these important public health and environmental protection statutes, will fully explore these issues before the Senate considers any changes.

As you know, the size of livestock operations has increased tremendously in recent years. Unlike in earlier decades, many of today's large-scale operations confine thousands, or even millions, of animals in closed buildings, producing huge volumes of waste material that can pose serious threats to air and water resources. A number of the large confined animal feeding operations generate as much waste as – or more than – a small city, but few of these facilities employ sophisticated means of treating this waste material.

Some large livestock operations now find themselves producing more waste than can be responsibly managed by traditional land application practices. Instead of responding to this situation by adopting more advanced treatment or moving waste materials outside of watersheds that cannot tolerate additional pollutant loadings, some operations simply "dump" excess manure. Whether they allow leaks and spills from manure storage lagoons, spray or apply manure to frozen or bare ground or simply overapply far in excess of the agronomic needs of crops, their practices result in pollution of groundwater and surface water with excess nutrients and dangerous pathogens, arsenic and other toxic metal compounds and antibiotics.

The City of Waco, Texas, for example, projects that it will spend more than $80 million for capital improvements specifically to deal with taste and odor problems caused by excessive phosphorus released from dairy cow waste. Facing what appeared to be ever-increasing water treatment expenditures to eliminate ever-increasing nutrient loadings from agricultural operations, the City urged upstream feeding operations to adopt better manure management techniques. When that effort failed, they used the most effective legal tool available: a CERCLA cost recovery suit. The suit – against 14 operations that had a history of problems – was used not to shut down dairies or collect monies from farmers, but to leverage new, enforceable agreements for better manure management at these facilities.

If Congress amends CERCLA with a special exemption for livestock waste, it will deny communities across America a critically important tool for protecting their invaluable water supplies from pollution caused by those large-scale agricultural operations that fail to properly manage their waste. It will declare that water users, not polluters, must bear the burdens of pollution, a radical shift in longstanding federal law.

Another impact of the proposed exemptions would be to prevent federal, state and local emergency responders from accessing information about toxic releases from these facilities. For example, many of the large feeding operations release extremely large volumes of hazardous air pollutants, such as ammonia and hydrogen sulfide. These volumes can exceed those produced by large, non-agricultural industries. A number of studies, including one by Iowa State University and the University of Iowa in 2002, have found a variety of health problems among animal feeding operation workers and residents who live near these operations, including bronchitis, asthma and antibiotic-resistant bacterial infections. These findings are of great concern to many rural communities, and action by Congress to ban reporting by these facilities would do a great disservice to those who are working hard to develop a better understanding of the full impacts of these releases.

Advocates for exempting livestock waste from CERCLA and EPCRA claim that livestock operations are strictly regulated under other environmental laws. In fact, the EPA and the states have failed to adequately control large-scale agricultural pollution using federal environmental laws. Even the largest livestock operations historically have not been regulated under the Clean Air Act, although many release harmful levels of air toxics such as ammonia and hydrogen sulfide. Nor has the Clean Water Act effectively controlled farm pollution. It has required large livestock operations to obtain permits for more than 30 years, but noncompliance has been widespread. The EPA estimates that only 8,500 of the nation's 18,800 Concentrated Animal Feeding Operations currently have Clean Water Act permits, even though approximately 14,000 facilities will need permits.

What's more, an animal feeding operation may be exempt from CERCLA to the extent that its releases are permitted by its Clean Water Act permit. In addition, livestock producers who are using their manure in quantities that crops can utilize are protected under the law. **CERCLA already includes a specific exception for the "normal field application of fertilizer."** Only those livestock operators who have excess manure, fail to find a viable alternative use, and so dump it on the land to get rid of it, rather than use it to fertilize crops, have potential liability.

Large livestock operations can be significant sources of pollution. Virtually all of them operate without the air pollution controls, and a significant number without the water pollution controls that are required for industrial facilities generating comparable quantities of waste. We urge you not to exempt hazardous substances associated with livestock waste from the health and environmental protections that CERCLA and EPCRA provide. Thank you for considering our views.

Sincerely,

Joan Mulhern
Senior Legislative Counsel
Earthjustice

Karla Raettig
Counsel
Environmental Integrity Project

Wenonah Hauter
Executive Director
Food and Water Watch

Sandra Schubert
Legislative Director
Environmental Working Group

Mimi Brody
Director of Federal Legislation
The Humane Society of the United States

Jim Harkness
President
Institute for Agriculture and Trade Policy

K.C. Duerig
Chair, Animal Factory Campaign Team
Western Organization of Resource Councils

Margaret Mellon
Director Food and Environment
Union of Concerned Scientists

Velma Smith
Senior Policy Associate
National Environmental Trust

Karen Wayland
Legislative Director
Natural Resources Defense Council

Debbie Sease
Legislative Director
Sierra Club

Martha Noble
Senior Policy Associate
Sustainable Agriculture Coalition

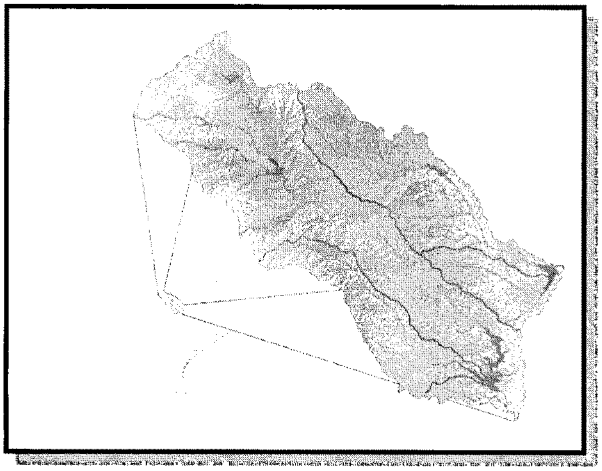
Anna Aurilio
Director, Washington DC Office
U.S. PIRG

Steve Fleischli
President
Waterkeeper Alliance

Brad Redlin
Director of Agricultural Programs
Izaak Walton League of America

CC: Members of the Senate Agriculture Committee
The Honorable Barbara Boxer, Chair, Senate Environment and Public Works Committee

ASSESSMENT OF BACTERIAL SOURCES IMPACTING LAKE WACO AND BELTON LAKE



Prepared for:

TEXAS FARM BUREAU

Prepared by:

PARSONS

TEXAS A&M UNIVERSITY AGRICULTURAL RESEARCH & EXTENSION CENTER AT EL PASO, TEXAS AGRICULTURAL EXPERIMENT STATION

TEXAS A&M UNIVERSITY – CORPUS CHRISTI

TEXAS A&M UNIVERSITY

Funding for this Project was provided by the Texas State Soil and Water Conservation Board through a Clean Water Act §319(h) grant from the U.S. Environmental Protection Agency, and funds from the Texas Farm Bureau, Brazos River Authority, and the City of Waco.

FEBRUARY 2006

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FEBRUARY 2006

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EXECUTIVE SUMMARY

This assessment report describes the investigation and categorization of the sources of fecal contamination in Lake Waco, Belton Lake, and portions of major tributaries to those lakes. While both Lake Waco and Belton Lake meet Texas Surface Water Quality Standards for contact recreation and public water supply, concerns have been expressed over potential fecal contamination from animal agriculture operations in their watersheds. This assessment project was initiated and coordinated by the Texas Farm Bureau (TFB), and funded by the Texas State Soil and Water Conservation Board (TSSWCB) through a Clean Water Act §319(h) grant from the U.S. Environmental Protection Agency (USEPA). Other financial, technical, and in-kind support for the project was provided by the TFB, the City of Waco, and the Brazos River Authority (BRA). Scientific and technical collaborators on the project included Parsons Water and Infrastructure Inc. (Parsons), the Texas A&M University Agricultural Research Extension Center at El Paso (EP AREC), Texas A&M University-Corpus Christi (TAMU-CC), and Texas A&M University (TAMU).

The two primary objectives of the project were to use bacterial source tracking (BST) methods to (1) assess the relative contributions of fecal bacteria from livestock (particularly cattle), humans, wildlife, and other animals in Lake Waco and Belton Lake; and (2) develop libraries of known bacteria sources, genetic and biochemical, which can be used in determining the origin (animal or human) of fecal contamination in surface water. As this was one of the first studies of its kind in the state, a secondary objective was to evaluate and compare several analytical methods for BST to identify the optimal method, or combination of methods, for future application in Texas. Given these objectives it should be noted that throughout this report data results are discussed and presented in relation to two separate but inter-dependent themes: 1) data results that support conclusions associated with different BST analytical methods; and 2) data results that support conclusions specific to bacteria sources identified in each watershed.

Water Sampling

The collection of all water quality samples was governed by approved sampling methods summarized in a TSSWCB- and USEPA-approved Quality Assurance Project Plan (QAPP). To obtain representative results, including wet and dry conditions and seasonal variation, the ambient water sampling was performed on a routine monthly schedule from September 2003 through June 2004, to capture dry and runoff-influenced events at their natural frequency. Four stations in Lake Waco, two stations on the North Bosque River upstream of Lake Waco, four stations in Belton Lake, and one station on the Leon River upstream of Belton Lake were sampled for *E. coli* on 10 dates. One of the 10 sampling events (November) appeared to be strongly influenced by rainfall runoff, based on streamflow increases as well as rainfall in the days just before the sampling event, while two other events (January and March) exhibited minor runoff influences at some sites.

Following collection, water samples were delivered to the City of Waco Laboratory for *E. coli* culturing and enumeration via the membrane filter modified mTEC method. A 6-hour holding time for sample delivery to the laboratory and initiation of analysis was maintained. Following incubation and enumeration using USEPA Method 1603, the modified mTEC plates with *E. coli* colonies were shipped on ice overnight to the BST laboratory at EP AREC for *E. coli* isolation, confirmation, and archival. A total of 650 water samples were collected, of which 412 were positive for *E. coli*. One to twelve *E. coli* were isolated from each positive water sample for a total of 631 isolates. Of these, 555 were analyzed by all four BST methods.

BST Library Development

The BST techniques used in this study are library-dependent. Therefore, it was necessary to construct reference libraries of genetic and phenotypic fingerprints for *E. coli* isolated from known sources (*e.g.,* domestic sewage, livestock, and wildlife) derived from each watershed. By matching the fingerprints of *E. coli* isolated from water samples with the fingerprints in the known source libraries, the likely animal or human (domestic sewage) fecal sources of surface water contamination can be determined.

The primary sampling design consideration for this BST study was to obtain as many unique *E. coli* library isolates as possible from individual animals or samples to represent the diversity and abundance of fecal contamination sources occurring in Lake Waco and Belton Lake watersheds. Potential fecal sources were identified through a sanitary survey conducted by Parsons. Between October 2003 and October 2004, a total of 994 fecal samples were collected from known sources. Municipal wastewater treatment plant influent/effluent and septage samples (collectively referred to as "domestic sewage"), livestock, wildlife, and pet fecal samples, were obtained from a variety of sources throughout the Lake Waco and Belton Lake watersheds based on the sanitary survey. An additional 100 *E. coli* isolates from south Texas non-avian wildlife from a previous BST study were also included (Mott and Lehman 2001).

Typically one to five *E. coli* isolates were archived for each source sample, while one to 12 isolates per water sample were archived. These frozen cultures can remain viable for years and can be easily shared with other researchers.

E. coli isolates from known source samples were screened using a repetitive sequence polymerase chain reaction method (ERIC-PCR). ERIC-PCR is a genetic fingerprinting method used in previous BST studies as well as many microbial ecology and epidemiological studies. In total, 2,275 *E. coli* isolates from know source samples were screened using ERIC-PCR. After determining the number of different *E. coli* ERIC-PCR types and exclusion of clones for each sample, one to three isolates per sample were selected for inclusion in the library. A total of 883 *E. coli* isolates were selected for the library and analyzed by all four BST methods.

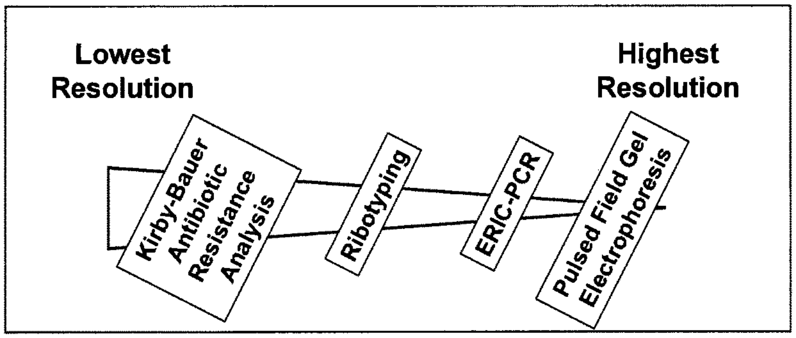
BST Methods

All methods selected for this project were used in previous BST studies, as well as other microbiological studies, and have been published in peer-reviewed journals. They span the spectrum in their ability to resolve differences in related bacterial strains, technical training and labor required, equipment cost, reagent cost, sample throughput, and ease of data analysis.

Figure ES-1 displays a conceptual sensitivity continuum of the BST methods used in this study. In this study, the combination of the DuPont RiboPrinter System, PFGE, ERIC-PCR, and KB-ARA allowed development of one of the most comprehensive

E. coli BST libraries and one of the first side-by-side comparisons of these BST methods. Recent BST studies also suggest that a combination of complementary methods may be the best approach for accurately identifying sources of contamination.

Figure ES-1 Discriminatory Capabilities of Different BST Methods



The validity of this study and the conclusions drawn from the results are strengthened through the use of the multiple techniques, and in particular, composite data sets. Further, by using standardized methods, the library can be expanded through future projects and the data shared with other BST investigators and regulatory agencies. Peer-reviewed publication of project results is also a goal, and journal manuscripts are being prepared as of the date of this report.

BioNumerics software (Applied Maths, Austin, TX) was used to analyze the BST data for this project. This software is currently used in many BST studies, especially for molecular fingerprint methods. For this project, BioNumerics was used in three ways: 1) processing gel images, 2) determining the relationships between the isolates by comparing their molecular fingerprint patterns for development of the BST libraries, and 3) for identification of water isolates.

Fingerprint patterns were compared individually for each of the molecular methods (ERIC-PCR, RiboPrinting, and PFGE) using the BioNumerics software. An equivalent comparison of the phenotypic KB-ARA profile treated the zone of inhibition measurements for each of the 20 antibiotics as character data to compare isolate profiles using the BioNumerics software. BioNumerics has the unique ability to allow the construction of composite data sets. A composite data set takes into account all four fingerprint profiles (ERIC-PCR, RiboPrinting, PFGE, and KB-ARA) or various combinations of these profiles for each isolate. Each BST method describes a different trait or aspect with different degrees of resolution or discrimination. An analogy would be the composite sketch of a suspect gathered from the descriptions of eye-witnesses to a crime, each having a different perspective. Composite data sets for only known library isolates and water isolates that had patterns for all four BST methods were created.

Host sources were divided into seven groups, 1) domestic sewage; 2) pet; 3) cattle; 4) other livestock, avian; 5) other livestock, non-avian; 6) wildlife, avian; and 7) wildlife, non-avian. The division of host sources into these particular classes was based on discussion with project participants and anticipated usefulness for the development of Best Management Practices (BMP).

Quality Control

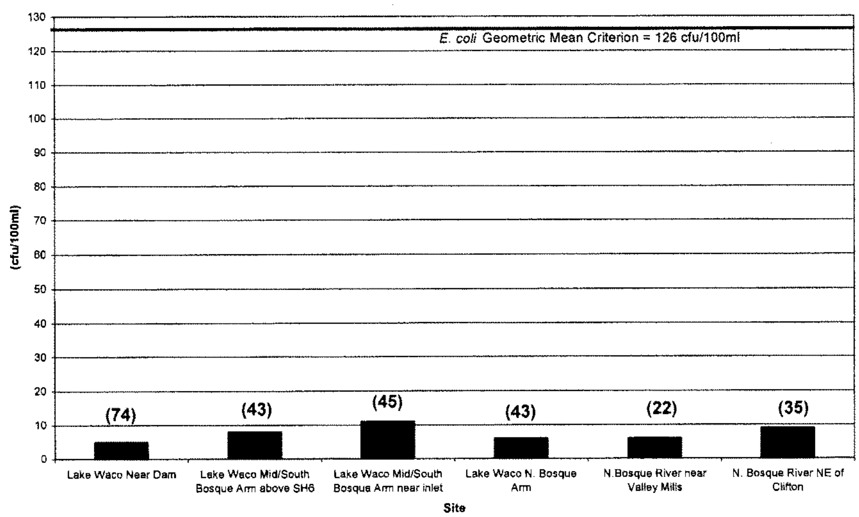
Standard laboratory practices were followed to assure quality data. Each laboratory method included additional required Quality Control (QC) measures. BST does not lend itself easily to the same QC methods as chemical quantification because each measurement is essentially qualitative, not quantitative. Therefore, in this study laboratory method accuracy and precision were quantified through a special QC study with blinded safeguards. The ERIC-PCR, RiboPrinting, and PFGE techniques performed equally well, with 100 percent identification of replicate isolates (precision) and 70 to 90 percent accuracy in identification of replicate isolates to specific QC library isolate (method accuracy) and correct source class (source identification accuracy). On the other hand, the KB-ARA scored only 40 percent for identification of replicate isolates (precision) and 50 percent for method and source identification accuracy. Most important, however, are the four-method composite data set results. The composite data set results correctly identified 100% of the replicate QC cultures (precision), and had 100% accuracy for *E. coli* strain and source class identification of the isolates. Therefore, the composite four-methods performed better than any single method.

The use of four different BST methods in this study provided valuable insights to BST methods. This is believed to be one of the first studies to directly compare BST methods by using the same collection of *E. coli* isolates. The methods used covered the spectrum in cost, ease of use, and discriminatory ability. As hypothesized, data from the combined methods (composite data set) were more useful than any individual method. Further, congruence measurements suggest that an ERIC-PCR and RiboPrinting composite data may be as useful as the four methods combined. In future studies, ERIC-PCR and RiboPrinting may be the methods of choice, and the other methods used to further characterize specific groups of isolates as needed. This would provide for cost, labor, and time savings while not compromising integrity of the BST result.

Levels of E. coli

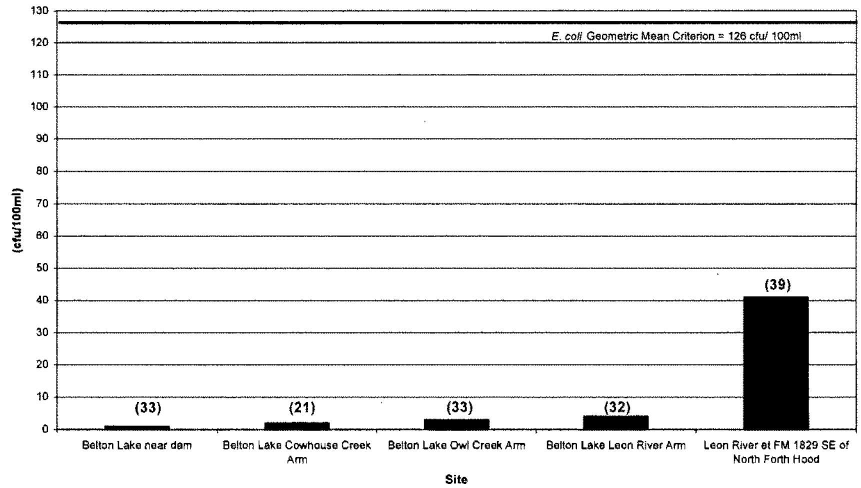
The *E. coli* samples collected during the study were assessed in accordance with the Texas Commission on Environmental Quality's Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004. Overall, the levels of *E. coli* observed in the samples collected from Lake Waco and North Bosque River were far below the contact recreation geometric mean water quality criterion of 126 *E. coli* per 100 ml. The geometric mean concentrations ranged from 5 cfu/100 ml at the Lake Waco site near the dam to 11 cfu/100 ml near the inlet of the Middle and South Bosque Rivers (Figure ES-2).

Figure ES-2 Geometric Mean of *E. coli* Concentrations - Lake Waco Sampling Sites, September 2003 through June 2004



In Belton Lake, *E. coli* levels were very low throughout the lake. *E. coli* were absent from 131 (52%) of the 250 samples collected. Geometric mean *E. coli* concentrations ranged from 1 cfu/100 ml near the dam to 4 cfu/100 ml in the Leon River arm. The highest *E. coli* levels of any site sampled in this study were observed in the Leon River upstream of Belton Lake. Concentrations ranged from 0 to more than 20,000 cfu/100 ml, and the geometric mean *E. coli* concentration was 41 cfu/100 ml (Figure ES-3).

Figure ES-3 Geometric Mean of *E. coli* Concentrations - Belton Lake Sampling Sites, September 2003 through June 2004



BST Results: Source Identification of Water Isolates

To facilitate the interpretation of results, it is helpful to have some understanding of the uncertainties involved in the source estimates. As the number of isolates identified increases, so does the confidence in the estimate of the source contribution. At select individual sampling sites a lower confidence exists in the precision of the source category percentages since only a few dozen *E. coli* isolates were identified.

There was a wide variety of contributing sources to each lake and at each sampling station, and no single source category dominated. Considering all Lake Waco and North Bosque River sites and dates combined (Figure ES-4), wild birds were identified as the contributors of 23 percent of the *E. coli* to water, followed by non-avian wildlife at 17 percent of the *E. coli*. Thus, wildlife contributed approximately 40 percent of the *E. coli* to Lake Waco. Livestock contributed 29 percent of the *E. coli*, with cattle contributing 16 percent, other livestock - avian at 3 percent, and other non-avian livestock at 10 percent. Sewage was identified as the source of an estimated 17 percent of the *E. coli*. Pets (dogs and cats) were estimated to contribute approximately 3 percent of the *E. coli*. The source of 11 percent of the *E. coli* could not be identified with acceptable confidence.

Considering all Belton Lake and Leon River sites and all dates combined (Figure ES-5), wild birds were identified as the contributors of 28 percent of the *E. coli* to water, followed by non-avian wildlife at 21 percent of the *E. coli*. Thus, wildlife contributed approximately half of the *E. coli* to Belton Lake. Livestock contributed 32 percent of the *E. coli*, with cattle contributing 17 percent, other livestock - avian at 2 percent, and other non-avian livestock at 13 percent. Sewage was identified as the source of an estimated

11 percent of the *E. coli*. Pets (dogs and cats) were estimated to contribute approximately 3 percent of the *E. coli*. The source of 5 percent of the *E. coli* could not be identified with acceptable confidence.

Figure ES-6 presents the same data in a different format to provide a side-by-side comparison which demonstrates that the sources of *E. coli* in Lake Waco and Belton Lake were similar. Sewage contributed a larger percentage of *E. coli* in the Lake Waco watershed, and wildlife represented a larger contribution in the Belton Lake watershed, but the differences are not statistically significant at the 95 percent confidence level.

Although source contribution estimates for individual sites are too imprecise for statistically significant comparisons, the highest sewage contributions were seen in Lake Waco near the dam, a site near heavily populated areas of the City of Waco. The highest contributions from cattle were observed in the Leon River arm of Belton Lake and the Middle/South Bosque River arm of Lake Waco. The largest contributions from other livestock - avian were observed in Belton Lake near the dam, and the highest contributions from other non-avian livestock were observed in the Leon River near north Fort Hood. The highest avian wildlife contributions were observed in the North Bosque River near Valley Mills, perhaps due to a large swallow population observed to be nesting under the bridge. Non-avian wildlife contributions were most substantial in the Owl Creek arm of Belton Lake and near the Belton Lake dam. The highest pet contributions were observed in the North Bosque River near Valley Mills and in the Cowhouse Creek arm of Belton Lake. At four of the 11 stations more than 10 percent of the isolates were not identifiable with Lake Waco Middle/South Bosque River arm at SH 6 having the highest percentage at 26.

Figure ES-4 Source Contribution Estimates using Four-Method Composite Data for all Lake Waco and North Bosque River Sites and all Dates Combined (348 *E. coli* Isolates)

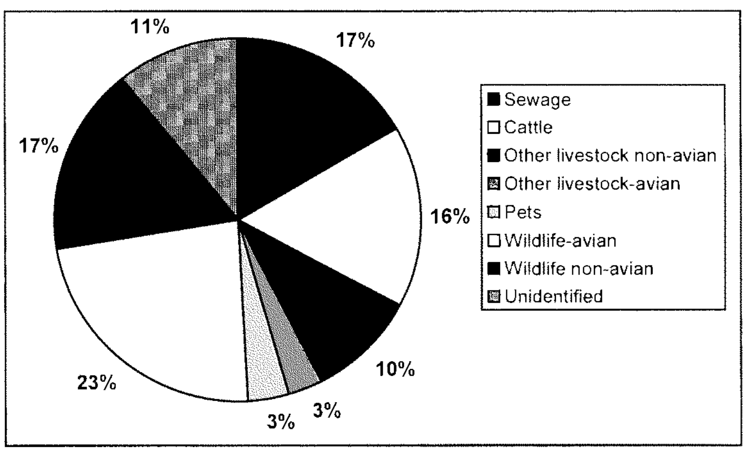


Figure ES-5 Source Contribution Estimates using Four-Method Composite Data for all Belton Lake and Leon River Sites and all Dates Combined (207 *E. coli* Isolates)

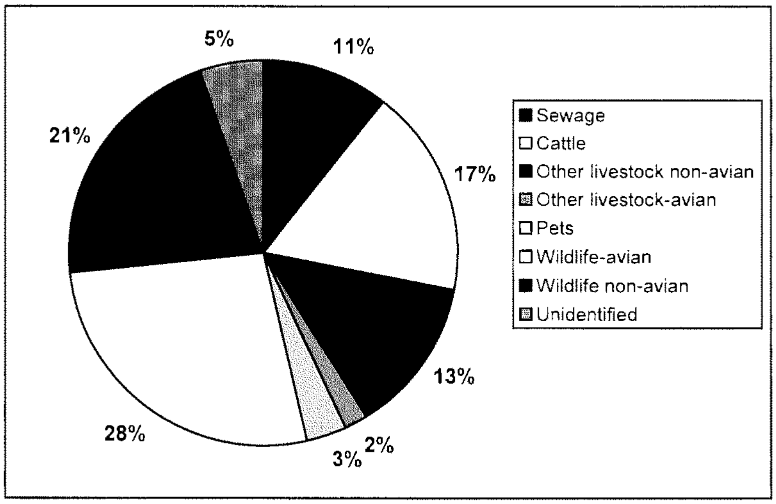
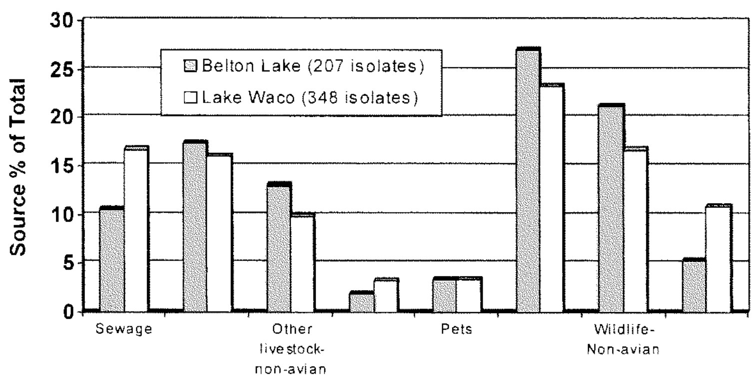


Figure ES-6 Comparison of Source Contribution Estimates for Belton Lake vs. Lake Waco using Four-Method Composite Data



Recommendations for Future BST Studies

Some of the key issues which affect data quality objectives (DQOs) and the sampling design of BST projects that must be given special attention are:

- budget,
- discriminatory capability desired of BST methods,
- size and diversity of known source library, and
- long-term maintenance of library isolates.

> ***Key Recommendations***
>
> - Special attention should also be given to ensuring that future BST projects in Texas adhere to a TCEQ- or TSSWCB-approved QAPP.
> - BST projects should adequately invest in conducting a thorough sanitary survey.
> - When considering the use of library dependent methods, special attention should be given to the long-term maintenance of the library isolates for future use and application.
> - The combination of ERIC-PCR and RiboPrinting appear to be the most suitable as well as accurate methods for future library-based BST studies.

Library size and the representativeness of *E coli* strains in a known source library are two major considerations that need to be carefully assessed before embarking on any BST study (USEPA 2005). The level of discriminatory capability desired will also drive DQOs. BST projects are typically designed to differentiate:

1) human vs. all other sources,
2) species specific results (human vs. cows vs. horses vs. deer, *etc.*),
3) group comparisons (human vs. livestock vs. wildlife), and
4) specific individual hosts (cows from a certain farm vs. other farms vs. other livestock on farms vs. human etc. (USEPA 2005).

It may not be feasible in terms of both cost and time considerations to perform all four BST methods used here for future BST studies. Through this project the ERIC-PCR RiboPrinting composite data set was found to be the closest two-method combination (90.7 percent similar) to the four-method composite data set. These results suggest that a combination of just ERIC-PCR and RiboPrinting may be most suitable for future library-based BST studies.

Conclusions from BST Results

The data now available from a BST study such as this validate the wide array of bacteria sources contributing loading to surface water. It should be recognized that data from BST studies such as this have limitations to the spatial and temporal questions that can be answered. This study has accomplished the project objectives and adhered to the data quality objectives set forth in the QAPP. The key conclusions derived from this BST project are:

- BST results indicate that wildlife (avian and non-avian) is the major contributor to fecal pollution for both Lake Waco and Belton Lake. Wildlife was identified as the source of 40 percent and 49 percent of the *E. coli* isolated from Lake Waco and Belton Lake water samples, respectively.

- It had been previously speculated that livestock, in particular cattle, and other agricultural activities were responsible for the majority of fecal pollution in these watersheds. Contributions to fecal pollution by cattle as determined by BST are similar for both Lake Waco and Belton Lake watersheds, with 16 percent and 17 percent of the *E. coli* isolates from water identified as cattle source, respectively. Looking at the contributions from cattle at each of the 11 monitoring stations at both lakes, the percentage is less than or equal to 25 percent. Thus, these results demonstrate that cattle are not the major contributing source of bacteria to Lake Waco and Belton Lake. If the cattle, other livestock - avian, and non-avian livestock source classes are combined into a "livestock" class, livestock appear to be the second leading source of fecal pollution, with 29 percent and 32 percent of the water isolates from Lake Waco and Belton Lake, respectively, identified to this source.
- Unexpectedly, domestic sewage is identified as the third leading contributor to fecal pollution in the watersheds, with 17 percent of the Lake Waco and 11 percent of the Belton Lake *E. coli* isolates identified to this source. Of particular concern is the finding that the sampling site with the highest occurrence (27%) of *E. coli* isolates identified as sewage is at Lake Waco near the dam (Station 11942), which is also near the drinking water treatment plant intake.
- The BST results provide valuable information that will assist water resource managers in targeting future management strategies to address bacteria contributions from specific source categories in each watershed.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ARA	Antibiotic resistance analysis
ARP	Antibiotic resistance profile
BHI	Brain heart infusion
BMP	Best management practice
BRA	Brazos River Authority
BST	Bacterial source tracking
CDC	Centers for Disease Control and Prevention
cfu	Colony forming unit (of bacteria)
DNA	Deoxyribonucleic acid
DQO	Data quality objective
E. coli	*Escherichia coli*
EP AREC	Texas A&M Agricultural Research and Extension Center at El Paso
ERIC-PCR	Enterobacterial repetitive intergenic consensus sequence polymerase chain reaction
FM	Farm to Market Road
ID	Identification
KB-ARA	Kirby-Bauer antibiotic resistance analysis
Magenta Gluc	5-bromo-6-chloro-3-indolyl-β-D-glucuronide
MGD	Million gallons per day
ml	Milliliter
MS4	Municipal Separate Storm Sewer System
MUG	4-methylumbelliferyl-β-D-glucuronide
NLCD	National Land Cover Data Set
NPDES	National Pollutant Discharge Elimination System
Parsons	Parsons Water and Infrastructure Inc.
PCR	Polymerase chain reaction
PFGE	Pulsed-field gel electrophoresis
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RCC	Rate of correct classification
RNA	ribonucleic acid
SH	state highway
SWMP	Stormwater Management Program
TAC	Texas administrative code
TAMU	Texas A&M University (College Station campus implied)
TAMU-CC	Texas A&M University – Corpus Christi
TBD	To be determined
TCEQ	Texas Commission on Environmental Quality
TFB	Texas Farm Bureau
TMDL	Total maximum daily load
TPDES	Texas Pollution Discharge Elimination System

ACRONYMS AND ABBREVIATIONS (*continued*)

TSB	Tryptone soy broth
TSSWCB	Texas State Soil and Water Conservation Board
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency

SECTION 1
INTRODUCTION

1.1 PROJECT OBJECTIVES AND DESCRIPTION

Protection of our water resources is one of the most significant environmental challenges of the new millennium. With over 260 surface water segments named to the Draft 2004 Texas §303(d) List because of nonsupport of contact recreation (TCEQ 2005a), quantifying the sources, fate, and transport of bacteria loading has become a priority to water resource managers and citizens around the state. Fecal contamination in surface water originates from a wide variety of point and nonpoint sources. Thus, a key need by water quality managers is identification and assessment of specific bacteria sources of microbial contamination in surface water. Proper evaluation of point and nonpoint sources is needed to identify appropriate control measures and best management practices (BMP) to control microbial pollution.

This assessment report describes the investigation and categorization of the sources of fecal contamination in Lake Waco, Belton Lake, and portions of major tributaries to those lakes. Figure 1-1 depicts the location and geographic extent of the Lake Waco and Belton Lake watersheds. While both Lake Waco and Belton Lake meet Texas Surface Water Quality Standards for contact recreation and public water supply, concerns have been expressed over potential fecal contamination from animal agriculture operations in their watersheds. This assessment project was initiated and coordinated by the Texas Farm Bureau (TFB), and funded in part by the Texas State Soil and Water Conservation Board (TSSWCB) through a Clean Water Act § 319(h) grant from the U.S. Environmental Protection Agency (USEPA). Other financial, technical, and in-kind support for the project was provided by the TFB, the City of Waco, and the Brazos River Authority (BRA). Scientific and technical collaborators on the project included Parsons Water and Infrastructure Inc. (Parsons), the Texas A&M University Agricultural Research Extension Center at El Paso (EP AREC), Texas A&M University-Corpus Christi (TAMU-CC), and Texas A&M University (TAMU).

The two primary objectives of the project were to use bacterial source tracking (BST) methods to (1) assess the relative contributions of fecal bacteria from livestock (particularly cattle), humans, wildlife, and other animals in Lake Waco and Belton Lake; and (2) develop libraries of known bacteria sources, genetic and biochemical, which can be used in determining the origin (animal or human) of fecal contamination in surface water. As this was one of the first studies of its kind in the state, a secondary objective was to evaluate and compare several analytical methods for BST to identify the optimal method, or combination of methods, for future application in Texas. Given these objectives it should be noted that throughout this report data results are discussed and presented in relation to two separate but inter-dependent themes: 1) data results that support conclusions associated with different BST analytical methods; and 2) data results that support conclusions specific to bacteria sources identified in each watershed.

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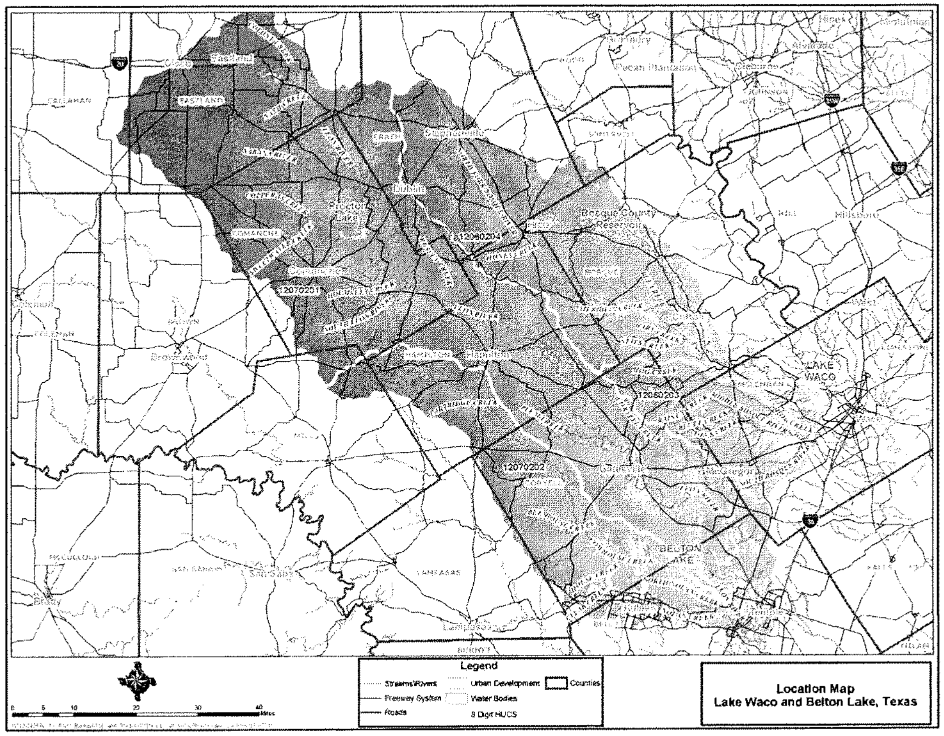
Figure 1-1 Lake Waco and Belton Lake Watersheds in Central Texas



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1.2 INTRODUCTION TO BACTERIAL SOURCE TRACKING

Fecal coliform bacteria are commonly used as an indicator of fecal pollution and the potential presence of other pathogenic microorganisms in water. Bacteria in ambient water may emanate from a wide variety of sources, including domestic sewage from wastewater collection systems, septic tanks, domestic pets, livestock, and wildlife. It has been established that the fecal coliform bacterium *Escherichia coli* (*E. coli*) is more closely associated with fecal pollution than other fecal coliform bacteria which may normally reside and multiply in the environment. *E. coli* is a common inhabitant of animal and human intestines; and recent studies show that isolates from humans and various host animals (*e.g.* cattle, chickens, and pigs) may differ genetically and phenotypically (*i.e.*, physical characteristics).

It is believed that different strains of *E. coli* have adapted to environmental conditions (temperature, pH, nutrient content, antibiotic exposure, *etc.*) in the intestines of specific warm-blooded animal hosts. These adaptations presumably allow certain *E. coli* strains to survive and compete favorably within the host's intestines, which gives rise to a level of host specificity among *E. coli*. Genetic and biochemical tests can identify specific strains of *E. coli*, which in the case of a host specific strain, may allow the original host animal to be identified, a process referred to as BST.

Molecular (genetic) tools appear to hold the greatest promise for BST, providing the most conclusive characterization and level of discrimination for isolates. Of the molecular tools available, ribosomal ribonucleic acid (RNA) genetic fingerprinting (ribotyping), enterobacterial repetitive intergenic consensus sequence polymerase chain reaction (ERIC-PCR) and pulsed-field gel electrophoresis (PFGE) are emerging as versatile and feasible BST techniques. Antibiotic resistance profiling, a phenotypic characterization method, also has the potential to identify the human or animal origin of isolates.

Each of these methods has its strengths and weaknesses. Ribotyping has a moderate ability to resolve different strains of the same species of bacteria. While an automated ribotyping system saves labor costs and requires little training, the initial investment and the consumable cost per isolate are expensive. PFGE has very high resolution and can discriminate between closely related strains. While this allows higher confidence in the matches made, fewer unknown isolates are typically identified compared to other BST techniques. ERIC-PCR has moderately high ability to resolve different strains of the same species of bacteria. Consumable costs for ERIC-PCR are inexpensive, but labor costs for sample processing and data analyses are moderate. Of the four methods applied in this study, antibiotic resistance analysis using the Kirby Bauer method has the lowest ability to discriminate closely related bacterial strains. It also has the lowest initial and per sample cost and takes the least time and training, but the statistical analysis of data can be complex and time-consuming. A disadvantage of all these techniques is that reference "libraries" or known sources of bacterial genetic fingerprints and antibiotic resistance profiles are needed to correctly identify the source of bacteria isolated from environmental water samples.

1.3 PROJECT DESCRIPTION

This assessment project began with the review and evaluation of existing data and information pertaining to bacterial contributions and sources to Lake Waco and Belton Lake. The primary task however, was the collection and analysis of new data, of known and specified quality, to differentiate and quantify the relative contributions of bovine livestock and other animal and human bacteria sources into Lake Waco and Belton Lake. The assessment and differentiation between bacteria sources were integrated with the development of the BST library generated by TAMU, EP AREC, and TAMU-CC. The tasks set out below were designed to provide sufficient documentation of the data and technical analyses conducted to aid the TFB in communicating the assessment results to watershed stakeholders, the TSSWCB, Texas Commission on Environmental Quality (TCEQ), and the USEPA, as necessary. The project was also structured to obtain support from stakeholders, TCEQ, TSSWCB, and USEPA Region 6 for the technical sufficiency of the project for application in other watersheds.

This project involved several steps:

- A sanitary survey of the watershed to identify potential contributing sources of fecal contamination based on existing literature and data as well as watershed reconnaissance.
- Coordination among all team members throughout the project and two stakeholder meetings, one at the beginning of the project and one to present results of the draft assessment report.
- Development of a sampling plan and quality assurance project plan (QAPP) to ensure that appropriate types and amount of data would be collected, and that the data would be reliable.
- Collection of fecal matter from known sources in the watershed to develop libraries of genetic signatures and antibiotic resistance profiles of *E. coli*.
- Collection and culturing of a representative set of *E. coli* isolates from Lake Waco, Belton Lake, and their major tributaries.
- Determination of the genetic signatures and antibiotic resistance profiles of these *E. coli* isolates from Lake Waco, Belton Lake, and their major tributaries.
- Application of statistical analysis to match the *E. coli* fingerprints from ambient water samples to those from known sources.
- Comparison and quantification of the accuracy and precision of four different BST methods and source determinations – antibiotic resistance analysis (ARA), enterobacterial repetitive intergenic consensus sequence polymerase chain reaction (ERIC-PCR), PFGE, and ribotyping. The BST techniques are described in more detail in Section 4 of this report.
- Estimation of the relative source contributions of *E. coli* in Lake Waco, Belton Lake, and their major tributaries, and the confidence of these estimates, based on the above measurements.

1.4 PROJECT TEAM AND COLLABORATION

Performance of this investigation involved collaboration of the TFB, TSSWCB, BRA, the City of Waco, Parsons, EP AREC, TAMU-CC, and TAMU. The following list identifies the organizations participating in the project with their specific roles and responsibilities. Figure 1-2 depicts the project organization chart.

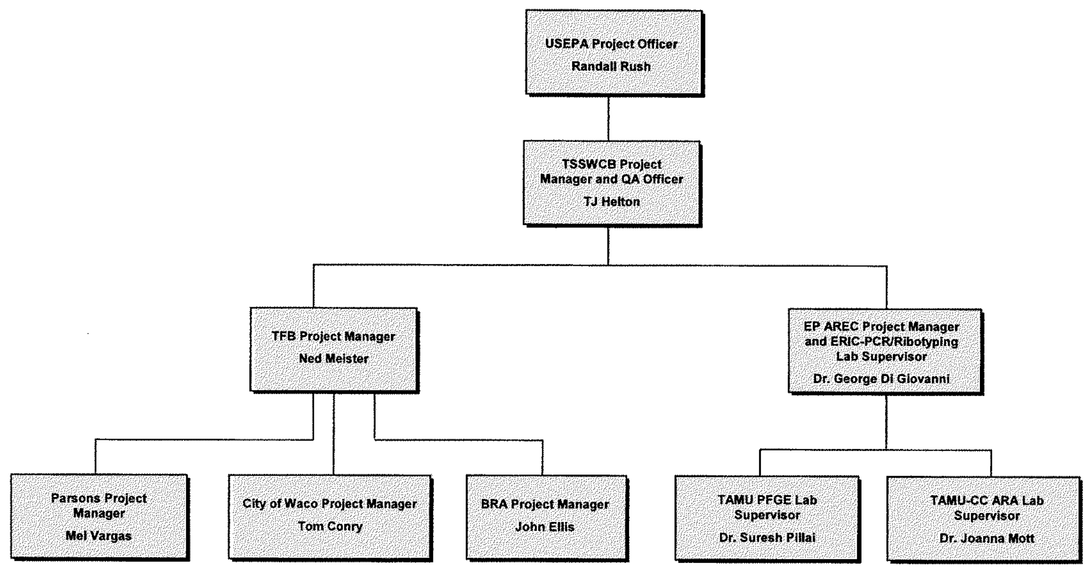
Team Members providing Project Management, Technical Direction, or Data Collection and Analysis:

- Texas Farm Bureau – Responsible for project coordination, review, and delivery of quarterly reports and the final project report to the TSSWCB.
- TSSWCB - Provided overall project review and approval. Obtained primary project funding with a Clean Water Act § 319(h) grant from the USEPA.
- City of Waco – Performed water sampling of Lake Waco. Responsible for the culturing and enumeration of *E. coli* in all ambient water samples and providing those cultures to the EP AREC laboratory.
- Brazos River Authority – Performed water sampling of Belton Lake.
- Parsons – Responsible for performing a sanitary survey of the watershed to identify potential fecal sources, collection of fecal samples from known sources for library development, collection of ambient water samples from the North Bosque River and Leon River, development of data quality objectives (DQO) and a QAPP, data analysis and interpretation (with EP AREC), and developing a final report for submittal to TFB and TSSWCB.

Team Members providing Laboratory Analysis and Data Analysis:

- Texas A&M Agricultural Research and Extension Center at El Paso – Responsible for isolation and purification of *E. coli* from fecal specimens and water samples, archival of *E. coli* cultures, ERIC-PCR screening and ribotyping of *E. coli* isolates, data analysis, and reporting tasks for the project, including (together with Parsons) development of data quality objectives (DQOs) and a QAPP. EP AREC was responsible (with the TFB and Parsons) for coordination, development, and delivery of quarterly reports as well as the final project report.
- Texas A&M University – Responsible for PFGE analysis of *E. coli* isolates provided by EP AREC. Responsible for PFGE data analysis and quality assurance (QA) procedures for that task.
- Texas A&M University – Corpus Christi – Responsible for ARA of *E. coli* isolates provided by EP AREC. Responsible for ARA data analysis and QA procedures for that task.

Figure 1-2 Project Organization Chart



SECTION 2
POTENTIAL SOURCES OF FECAL CONTAMINATION IN WATERSHEDS OF LAKE WACO AND BELTON LAKE

A critical step in any BST project is conducting a sanitary survey. A sanitary survey involves compiling existing information and conducting field reconnaissance regarding land use, population density, wastewater and stormwater infrastructure, agricultural practices and species census, and wildlife census to assist in identifying the potential sources of fecal contamination within the contributing watersheds of Lake Waco and Belton Lake. Conducting the sanitary survey provided information valuable in designing the approach for collecting ambient water samples and the known fecal samples for the library. This section summarizes information from the sanitary survey.

2.1 WATER BODY CHARACTERISTICS

2.1.1 Lake Waco

Lake Waco is a 7,178-acre reservoir in McLennan County, Texas, located entirely within the city limits of Waco. Lake Waco, segment 1225, serves as the water supply for over 110,000 central Texans (TCEQ 2005b). The dam at the northern end of the lake, completed in 1964 by the U.S. Army Corps of Engineers, impounds the North Bosque River to a normal pool elevation of 462 feet (USACE 2005). Other major tributaries include the Middle Bosque River, South Bosque River, and Hog Creek. The lake's primary purposes include flood control and water conservation.

In Texas Surface Water Quality Standards (Texas Administrative Code [TAC] §§307.1-307.10), the designated uses of Lake Waco include aquatic life use, contact recreation use, general use, fish consumption use, and public water supply use. All of these uses, except fish consumption which was not assessed, were determined to be supported by TCEQ in the Draft 2004 Texas Water Quality Inventory and §303(d) List (TCEQ 2005a). This assessment listed concerns over nutrient enrichment by nitrate and nitrite nitrogen, and excessive algal growth. Historically the TCEQ has relied on fecal coliform data collected from streams and lakes to assess support or nonsupport of the contact recreation use. Fecal coliform data was compiled and assessed in accordance with the TCEQ Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004. The geometric mean of 53 fecal coliform measurements in the lake near the dam between March 1996 and February 2001 was 9.5 colony forming units (cfu)

> ***Contact Recreation Use Assessment***
>
> In its *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004*, the TCEQ states "For routinely monitored bacteria data, the following long-term geometric averages have been established as criteria: fecal coliform, 200 cfu/100 ml; *E.coli*, 126 cfu/100 ml; and Enterococci, 35 cfu/100 ml. A fecal coliform criterion of 400 cfu/100 ml, an *E.coli* criterion of 394 cfu/100 ml, and an Enterococci criterion of 89 cfu/100 ml also apply to individual grab samples. The contact recreation use is not supported if the geometric average of the samples collected exceeds the mean criterion or if the criteria for individual samples are exceeded greater than 25 percent of the time... (TCEQ 2004)

per 100 milliliter (ml) of water, far less than the geometric mean water quality criterion of 200 cfu/100 ml. Two of the 53 samples near the dam exceeded the single sample water quality criterion of 400 cfu/100 ml. In the North Bosque River Arm of the lake, the geometric mean of 68 fecal coliform measurements during the same period was 11.17 cfu/100 ml. None of these 68 measurements exceeded the single sample criterion. In the Middle/South Bosque River Arm of the lake, the geometric mean of 67 fecal coliform measurements during the same period was 2 cfu/100 ml. Four of the 67 measurements exceeded the single sample water quality criterion of 400 cfu/100 ml.

2.1.2 Lake Waco Tributaries

The North Bosque River supports contact recreation use. The geometric mean of 30 fecal coliform samples collected from the portion of the North Bosque just upstream of Lake Waco was 88 cfu/100 ml, and five of the 30 samples, or 17 percent, exceeded the single sample criterion.

Hog Creek supports contact recreation use. The geometric mean of 106 fecal coliform samples was 115 cfu/100 ml, and 16 of the 106 samples, or 15 percent, exceeded the single sample criterion.

The Middle Bosque River supports contact recreation use. The geometric mean of 82 fecal coliform samples was 105 cfu/100 ml, and 13 of the 82 samples, or 16 percent, exceeded the single sample criterion.

The South Bosque River supports contact recreation use. The geometric mean of 101 fecal coliform samples was 145 cfu/100 ml, and 21 of the 101 samples, or 21 percent, exceeded the single sample criterion.

2.1.3 Belton Lake

Belton Lake is a 12,300-acre reservoir in Bell and Coryell Counties, roughly 3 miles north of the City of Belton and approximately 8 miles west of the City of Temple. Belton Lake, segment 1220, serves as the water supply for over 280,000 central Texans (TCEQ 2005b). The dam near Belton, completed in 1954 by the U.S. Army Corps of Engineers, impounds the Leon River to a normal pool elevation of 594 feet. In addition to the Leon River, other major tributaries include Cowhouse Creek and Owl Creek. In addition to providing flood control, numerous parks and recreational facilities and wildlife management areas rim the lake.

In Texas Surface Water Quality Standards (30 TAC §§307.1-7), designated uses of the lake include aquatic life use, contact recreation use, general use, fish consumption use, and public water supply use. All these uses except fish consumption, which was not assessed, were determined to be supported by TCEQ in the Draft 2004 Texas Water Quality Inventory and §303(d) List (TCEQ 2005a). Nutrient enrichment of the lake due to nitrate and nitrite nitrogen levels was identified as a concern.

The geometric mean of 66 fecal coliform measurements in the lower reaches of the lake between March 1996 and February 2001 was 3 cfu/100 ml of water. In the upper reaches of the lake, the geometric mean of 29 fecal coliform measurements during the same period was 4 cfu/100 ml. These concentrations were well below the contact recreation water quality criterion of 200 cfu/100 ml. No single measurements exceeded the fecal coliform single sample criterion of 400 cfu/100 ml.

2.1.4 Belton Lake Tributaries

Among the tributaries to Belton Lake, some portions of the Leon River below Lake Proctor (segment 1221) did not support contact recreation because of elevated levels of fecal coliform bacteria, while other portions did support contact recreation. Contact recreation was supported in the portion of the Leon River just upstream of Lake Belton. The geometric mean of 19 fecal coliform measurements between March 1996 and February 2001 was 176 cfu/100 ml, which meets the water quality criterion of 200 cfu/100 ml. Four of the 19 samples, or 21 percent, exceeded the single sample criterion of 400 cfu/100 ml, which is below the threshold for nonsupport of contact recreation use. The portions of Leon River not supporting contact recreation were in northern Hamilton and southern Comanche Counties.

Cowhouse Creek fully supports contact recreation use. The geometric mean of 22 samples was 38 cfu/100 ml, and three of the 22 samples, or 14 percent, exceeded the single sample criterion.

2.2 WATERSHED CHARACTERISTICS

The Lake Waco watershed covers approximately 1,655 square miles. It extends westward from Waco to McGregor, then progresses northwest upstream along the North Bosque River. Approximately 74 percent of the watershed area is in the North Bosque River drainage, with the balance divided between the Middle Bosque River (12%), the South Bosque River (5%), Hog Creek (5%), and direct drainage to the lake from its east (1%), north (1%), and west (2%) shores. The watershed covers parts of six Texas Counties: Bosque, Coryell, Erath, Hamilton, McLennan, and Somervell. Cities and towns partially or wholly within the Lake Waco watershed include Stephenville, Dublin, Hico, Meridian, Iredell, Cranfills Gap, Clifton, Valley Mills, Crawford, McGregor, Woodway, and Waco.

The Belton Lake watershed covers approximately 3,568 square miles, slightly more than double the size of the Lake Waco watershed. It extends westward from the western edge of Temple to the northern edge of Killeen, then progresses northwest upstream along Cowhouse Creek and Leon River. Approximately 74 percent of the watershed area is in the Leon River drainage, with the balance divided between Cowhouse Creek drainage (20%), Owl and Flint Creek drainages (2%), and direct drainage to the lake from its immediate vicinity (4%). The watershed covers parts of 12 Texas Counties: Bell, Brown, Callahan, Comanche, Coryell, Eastland, Erath, Hamilton, Lampasas, McLennan, Mills, and Stephens. Cities and towns in the Belton Lake watershed include Ranger, Eastland, Dublin, Cisco, Carbon, Gorman, DeLeon, Rising Star, Comanche, Gustine, Hamilton, Gatesville, Evant, South Mountain, Morgan's Point Resort, McGregor, Copperas Cove, and small portions of Belton, Temple, and Killeen.

2.3 WATERSHED LAND USE

Figure 2-1 displays land use/land cover data for the Lake Waco watershed from the National Land Cover Data Set (NLCD) (U.S. Geological Survey [USGS] 1999), which was developed from satellite photographs taken in the early 1990s. The most dominant land use/land cover categories, detailed in Table 2-1, are grasslands, shrubland, forest, and planted/cultivated agricultural lands. Developed land comprises less than 2 percent of the watershed. Figure 2-2 displays the land use/land cover data for the Belton Lake watershed which, overall, has similar percentages to that of the Lake Waco watershed, as summarized in Table 2-2.

Figure 2-1 Land Use/Land Cover for Lake Waco Watershed

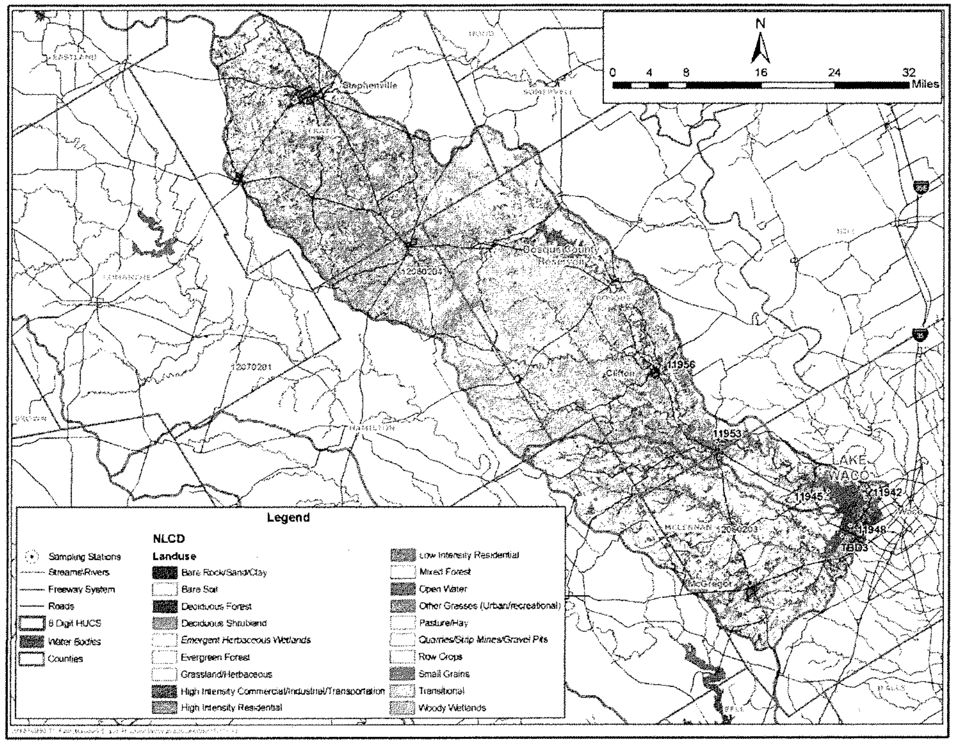


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Figure 2-2 Land Use/Land Cover for Belton Lake Watershed

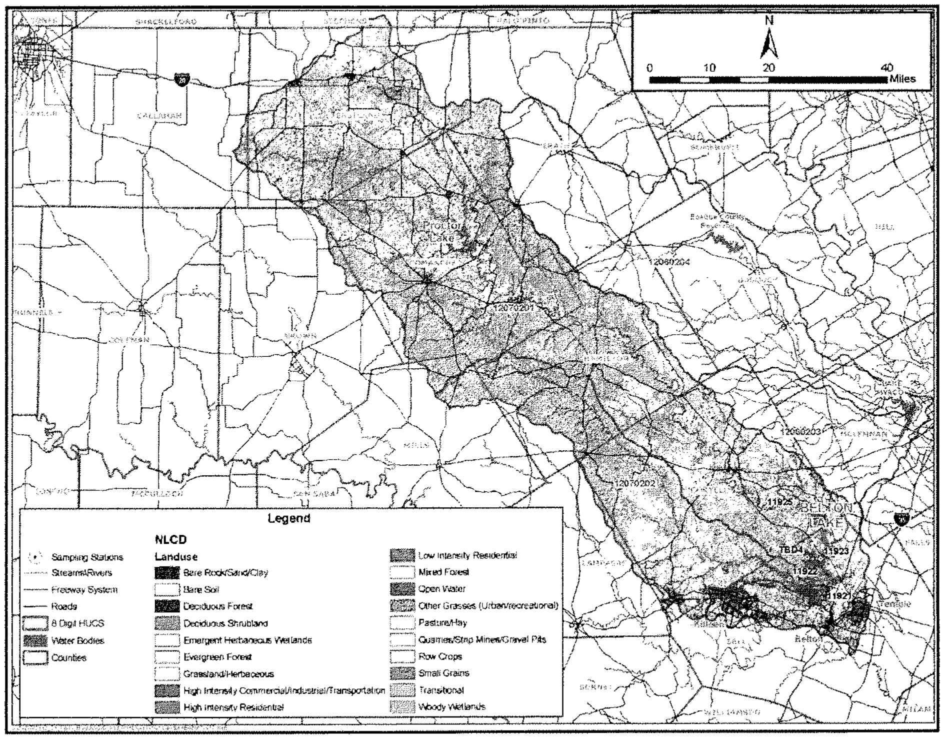

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Table 2-1 Land Use/Land Cover Summary for Lake Waco Watershed

Land Use	Acres	% of Total
Grassland/Herbaceous	346,662	32.69
Deciduous Shrubland	267,375	25.21
Evergreen Forest	105,182	9.92
Deciduous Forest	101,375	9.56
Pasture/Hay	87,291	8.23
Row Crops	62,788	5.92
Small Grains	44,568	4.20
Open Water	21,876	2.06
Commercial/Industrial/Transportation	7,664	0.72
Bare Rock/Sand/Clay	6,575	0.62
Low Intensity Residential	3,365	0.32
High Intensity Residential	3,188	0.30
Other Grasses (Urban/recreational)	1,203	0.11
Quarries/Strip Mines/Gravel Pits	625	0.06
Emergent Herbaceous Wetlands	506	0.05
Planted/Cultivated (orchards, vineyards, groves)	142	0.01
Mixed Forest	17	0.00
Bare Soil	0	0.00
Woody Wetlands	0	0.00
	1,060,403	**100.00**

Source: National Land Cover Dataset (USGS 1999)

Table 2-2 Land Use/Land Cover Summary for Belton Lake Watershed

Land Use	Acres	% of Total
Deciduous Shrubland	758,719	31.74
Grassland/Herbaceous	743,511	31.10
Deciduous Forest	209,949	8.78
Evergreen Forest	189,156	7.91
Row Crops	162,529	6.80
Pasture/Hay	112,507	4.71
Small Grains	88,775	3.71
Open Water	46,126	1.93
Commercial/Industrial/Transportation	21,283	0.89
Low Intensity Residential	19,318	0.81
Bare Rock/Sand/Clay	19,057	0.80
High Intensity Residential	12,641	0.53
Other Grasses (Urban/recreational)	3,259	0.14
Quarries/Strip Mines/Gravel Pits	1,181	0.05
Emergent Herbaceous Wetlands	922	0.04
Mixed Forest	212	0.01
Bare Soil	842	0.04
Woody Wetlands	745	0.03
Planted/Cultivated (orchards, vineyards, groves)	23	0.00
	2,390,756	**100.00**

Source: National Land Cover Dataset (USGS 1999)

2.4 HUMAN AND PET POPULATIONS, AND SEWAGE DISPOSAL

The total human population of the Lake Waco watershed was estimated from the 2000 federal census (U.S. Census Bureau 2003) to be approximately 78,000 with an overall average population density of 47 persons per square mile. In the Belton Lake watershed, the population was estimated to be approximately 113,000, with an average population density of 32 persons per square mile.

Based on the number of households in the watersheds, and national averages of pet ownership from the American Veterinary Medical Association (AVMA 2004), approximately 20,000 domestic dogs and 23,000 cats reside in the Lake Waco watershed, and 25,000 dogs and 29,000 cats reside in the Belton Lake watershed. Pet fecal waste can represent a major source of fecal contamination to water bodies, particularly during rainfall events when runoff washes fecal material into streams. Table 2-3 summarizes the population estimates of humans and pets by watershed.

Table 2-3 Estimated Populations of Humans and Pets

Category		Lake Waco Watershed	Belton Lake Watershed
Human	Humans#	78,000	113,000
Pets	Cats*	23,000	29,000
Pets	Dogs*	20,000	25,000

 # Based on 2000 U.S. Census

**Based on 2000 U.S. Census and 2002 U.S. Pet Ownership & Demographics Sourcebook, American Veterinary Medical Association*

Sewer line breaks, bypasses, and overflows can contribute substantial quantities of fecal contamination to rivers and streams. Residents of approximately 71 percent of the housing units in the Lake Waco watershed, and 62 percent of the units in the Belton Lake watershed, reported in the 1990 federal census that their sewage was disposed via public sanitary sewer to a wastewater treatment facility[1]. However, approximately 8,600 homes in the Lake Waco watershed, and 14,700 homes in the Belton Lake watershed reported in this census that they utilized septic tanks or other unspecified non-sewer means for sewage disposal. Malfunctioning septic tanks can represent a significant source of fecal contamination to surface and ground waters, especially in areas near lakes and streams, and areas with shallow groundwater tables or impermeable clay soil. The rate of septic tank malfunction was estimated at 12 percent in the counties comprising the lower portions of the Lake Waco and Belton Lake watersheds, and 8 percent in the counties in the upper portions of the watersheds, based on a survey of officials with the responsibility for permitting septic tanks (Reed, Stowe, and Yanke 2001). The two primary factors listed as causes of malfunction were inappropriate soil type and age of the systems.

[1] This question was not asked in the 2000 federal census. The percentage of households connected to a public sanitary sewer may have increased somewhat since 1990 due to new housing outside sewered areas. For example, since 2001, the City of Waco reported extending sanitary sewers to serve 400 homes formerly utilizing septic tanks near Lake Waco.

Septic tanks are generally inappropriate for dense developments. New septic tanks are not allowed on lot sizes smaller than one-half acre (30 TAC §285.4), and problems may occur at lower densities. With the low spatial resolution of available data, it was not possible to identify particular geographic areas where the density of septic tanks exceeds recommended limits.

2.5 WATERSHED LIVESTOCK POPULATIONS

Table 2-4 summarizes livestock populations estimated from the 2002 Census of Agriculture, conducted by the National Agricultural Statistics Service of the U.S. Department of Agriculture (USDA) (USDA 2002), or from more recent (January 1, 2005) estimates of the Texas Agricultural Statistics Service, when available. These data are available only at the county level, and since the watersheds generally include only a portion of the counties, these estimates were calculated from the sum of the county populations multiplied by the fraction of the county within the watershed. Thus, these should be considered rough approximations.

Cattle were the most abundant species in both watersheds, and beef cattle and cows outnumbered dairy cows by a wide margin. Dairy cows were most abundant in Erath and Comanche Counties, relatively far upstream from Lake Waco and Belton Lake. Goats and sheep were also abundant in both watersheds, particularly in Mills County. Chickens were abundant in the Lake Waco watershed.

Table 2-4 Estimated Livestock Populations by Watershed

Category		Lake Waco Watershed	Belton Lake Watershed
Livestock	Cattle & Calves-All†	149,000	313,000
Livestock	Beef cows†	52,000	131,000
Livestock	Dairy cows	37,000[a]	57,000[a]
Livestock	Horses, mules, burros, & donkeys‡	3,100	4,400
Livestock	Hogs & Pigs‡	1,200	9,500
Livestock	Goats†	18,000	49,000
Livestock	Sheep†	7,600	30,000
Livestock	Rabbits‡	150	130
Livestock	Chickens‡	77,000	5,100
Livestock	Other poultry‡	1,600	1,000

† *As of January 1, 2005 Texas Agricultural Statistics Service*

‡ *2002 Census of Agriculture, USDA*

[a] *Based on TCEQ inspection reports of permitted facilities for fiscal year 2004-2005, with estimates for smaller facilities (max 200 head each) under the jurisdiction of the TSSWCB. Source: Texas Institute for Applied Environmental Research, Tarleton State University*

Livestock manure applied to land as fertilizer can serve as a source of fecal contamination to surface water if it is incompletely composted, not adequately incorporated into the soil, or if heavy rains fall on freshly applied manure. Based on county level reports from the 2002 Census of Agriculture, it is estimated that manure was applied to approximately 10,000 acres, or approximately 0.9% of the land area of the Lake Waco watershed, and to approximately 17,000 acres, or approximately 0.7% of the area of the Belton Lake watershed. The Implementation Plan for Soluble Reactive Phosphorus in the North Bosque River Watershed (TCEQ 2002) established a target for composting and exporting 50 percent of the dairy manure from the watershed. Between 2001 and August 2004, 495,368 tons of dairy manure were collected and composted by the TCEQ/TSSWCB Composted Manure Incentive Program, and 156,141 tons were exported from the watershed (TCEQ 2005c). While the goal of the Composted Manure Incentive Program is to reduce loadings of phosphorus in the North Bosque River, it should also reduce fecal contamination.

2.6 WATERSHED WILDLIFE POPULATIONS

Although wildlife can clearly contribute fecal contamination to surface water, it is difficult to develop population estimates to gauge the potential impact. White-tailed deer are very common throughout the region. Waterfowl are also seasonally abundant – the Texas Parks and Wildlife Department (TPWD) estimates that the mid-winter duck population of Texas averaged 3.6 million from 1997 to 2005, with perhaps 15 percent of those observed in central Texas (TPWD 2005). Fecal contamination from waterfowl is expected to be enhanced because much of their feces are deposited directly into or adjacent to water bodies. It is a general expectation that wildlife species that tend to occur near streams will cause more fecal contamination of water than their more upland counterparts. For example, fecal contamination from a raccoon might be expected to exceed that from an armadillo.

2.7 POINT SOURCES OF POTENTIAL FECAL CONTAMINATION

2.7.1 Permitted Wastewater Discharges

Under the Texas Pollution Discharge Elimination System (TPDES), 15 active facilities hold permits to discharge wastewater into Lake Waco and its tributaries (Table 2-5), and 28 facilities hold permits to discharge wastewater into Belton Lake and its tributaries (Table 2-6). The current average total wastewater discharges to Lake Waco tributaries is approximately 3.4 million gallons per day (MGD). Current average wastewater discharges to Belton Lake and its tributaries are estimated to total 6.4 MGD. Most of the wastewater permits do not include specific limits and monitoring requirements for fecal coliform concentrations in their effluents, but most do require monitoring of disinfection of wastewaters. Several additional facilities and agricultural operations hold irrigation/ agricultural (no discharge) permits.

Table 2-5 Permitted Wastewater Discharges to Lake Waco and its Tributaries

Permit Identification (ID)	Facility	Dates Monitored	Reported Average Flow (MGD)	Permitted Average Flow (MGD)	Receiving Water
WQ0010043	City of Clifton	12/1/2003 – 7/31/2005	0.35	0.65	North Bosque River
WQ0010113	City of Meridian	7/1/2004 – 7/31/2005	0.31	0.45	North Bosque River
WQ0010188	City of Hico	8/1/2004 – 7/31/2004	0.41	0.20	North Bosque River
WQ0010219	City of McGregor	11/30/2001 – 6/30/2005	0.70	0.99	South Bosque River
WQ0010290	City of Stephenville	4/1/2004 - 7/31/2005	1.5	3.5	Upper North Bosque River
WQ0010307	City of Valley Mills	12/1/2004 – 6/30/2005	0.055	0.36	North Bosque River
WQ0010656	City of Crawford	2/1/2004 – 7/31/2005	0.014	0.09	Middle Bosque River
WQ0011565	City of Iredell	9/1/2004 – 7/31/2005	0.041	0.049	North Bosque River
WQ0013436	City of Walnut Springs	NR	NR	0.065	North Bosque River
WQ0013966	Stephenville Mobile Home Park	NR	NR	0.007	Upper North Bosque River
WQ0013971	City of Waco Mt. Carmel Plant	5/1/2004 – 7/31/2005	0.04	0.24	Lake Waco
WQ0014169	City of Cranfills Gap	9/1/2004 – 6/30/2005	0.027	0.04	North Bosque River
WQ0003041	Chemical Lime	NR	NR	NR	North Bosque River
WQ0003074	Schreiber Foods/Dairy Farmers of America	NR	NR	0.20	Upper North Bosque River
WQ0004573	Ronald Eugene Schaefer	NR	NR	NR	Upper North Bosque River
Total			**3.4**	**6.8**	

Notes:
NR = Not reported.
MGD = millions of gallons per day.

Table 2-6 Permitted Wastewater Discharges to Belton Lake and its Tributaries

Permit ID	Facility	Dates Monitored	Reported Average Flow (MGD)	Permitted Average Flow (MGD)	Receiving Water
WQ0010045-4	City of Copperas Cove Northeast Plant	6/1/2005 – 7/31/2005	0.65	2.5	Cowhouse Creek
WQ0010045-5	City of Copperas Cove Northwest Plant	12/1/2004 – 8/31/2005	1.87	4.0	Cowhouse Creek
WQ0010078	City of De Leon	11/1/2004 – 2/28/2005	0.160	0.295	Leon River above Lake Proctor
WQ0010091	City of Gorman	6/1/2004 – 7/31/2005	0.04	0.12	Leon River above Lake Proctor
WQ0010176-1 WQ0010176-4	City of Gatesville Leon WWTP	9/1/2002 – 7/31/2005	0.54	1.0	Leon River below Lake Proctor
WQ0010176-2	City of Gatesville WWTP # 2	11/1/2004 – 8/31/2005	1.33	2.2	Leon River below Lake Proctor
WQ0010176-3	City of Gatesville WWTP	7/1/2004 – 7/31/2005	0.24	0.25	Leon River below Lake Proctor
WQ0010225	City of Moody	6/1/2004 – 7/31/2005	0.12	0.20	Belton Lake
WQ0010351-1	Bell Co. WCID #1		NR	NR	Belton Lake
WQ0010405	City of Dublin	12/1/2004 – 8/31/2005	0.25	0.45	Leon River below Lake Proctor
WQ0010492-2	City of Hamilton	11/1/2003 – 7/31/2005	0.34	0.44	Leon River below Lake Proctor
WQ0010637	City of Eastland	8/1/2004 – 7/31/2005	0.37	0.9	Leon River above Lake Proctor
WQ0010719 WQ0014445	City of Comanche	2/1/2004 – 7/31/2005	0.289	0.595	Leon River below Lake Proctor
WQ0010841	City of Gustine	11/1/2004 – 5/31/2005	0.020	0.082	Leon River below Lake Proctor
WQ0010888	NJB & Sons Greenbrier Golf Club	9/1/2004 – 6/30/2005	0.001	0.005	Belton Lake
WQ0010914	City of Oglesby	4/1/2004 – 7/31/2005	0.032	0.05	Leon River below Lake Proctor
WQ0010918-2	City of Morgan's Point Resort	NR	NR	NR	Belton Lake
WQ0011011	City of Evant	NR	NR	0.06	Cowhouse Creek
WQ0002233 WQ0002230	U.S. Army Fort Hood	NR	NR	NR	Cowhouse Creek
WQ0012096	U.S. Army North Fort Hood	NR	NR	0.25	Leon River below Lake Proctor

Table 2-6 Permitted Wastewater Discharges to Belton Lake and its Tributaries (*continued*)

Permit ID	Facility	Dates Monitored	Reported Average Flow (MGD)	Permitted Average Flow (MGD)	Receiving Water
WQ0013726	Eastland County WSD	NR	NR	0.1	Leon River above Lake Proctor
WQ0013965 WQ0014515	City of Rising Star	NR	NR	0.14	Leon River above Lake Proctor
WQ0014206	Upper Leon River WMD	2/1/2005 – 7/31/2005	0.096	0.249	Leon River below Lake Proctor
WQ0011764	Upper Leon River WMD	NR	NR	0.06	Leon River above Lake Proctor
WQ0014481	Sobrante Management	NR	NR	NR	Belton Lake
WQ0002335	U.S. Navy Weapons Plant	NR	NR	0.20	Leon River below Lake Proctor
WQ0004464	City of Gatesville	NR	NR	NR	Leon River below Lake Proctor
WQ0004749	Comanche Pottery	NR	NR	0.00035	Leon River above Lake Proctor
Total			**6.4**	**14.1**	

Notes:
NR = Not reported.
MGD = millions of gallons per day.

The National Pollution Discharge Elimination System (NPDES) Phase II rule, promulgated in 1999, requires municipalities in urban areas to obtain permits for their stormwater systems. These permits, known as Municipal Separate Storm Sewer System (MS4) permits, require cities to reduce discharges of pollutants in stormwater to the "maximum extent practicable" by developing and implementing a Stormwater Management Program (SWMP). The SWMPs require specification of BMPs for six minimum control measures:

- Public education and outreach;
- Public participation/involvement;
- Illicit discharge detection and elimination;
- Construction site runoff control;
- Post-construction runoff control; and
- Pollution prevention/good housekeeping.

The City of Waco and Texas Department of Transportation jointly hold an MS4 permit for the Waco urban area. Of the municipalities in the Belton Lake watershed, only Temple is designated as an urban area that must comply with the requirements of the NPDES Phase II program.

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SECTION 3
AMBIENT WATER SAMPLING

3.1 SAMPLING PLAN AND PROCEDURES

A primary objective of this BST project was identification and quantification of the relative contributing sources of *E. coli* to Lake Waco and Belton Lake. The collection of all water quality samples was governed by approved sampling methods summarized in a TSSWCB- and USEPA-approved QAPP. Four stations in Lake Waco, two stations on the North Bosque River upstream of Lake Waco, four stations in Belton Lake, and one station on the Leon River upstream of Belton Lake were sampled for *E. coli* on 10 dates. The location descriptions of water quality monitoring stations are listed in Table 3-1 and displayed in Figures 3-1 and 3-2. To obtain results representative of the normal occurrence of wet and dry conditions and seasonal variation, the ambient water sampling was performed on a routine monthly schedule from September 2003 through June 2004, to capture dry and runoff-influenced events at their natural frequency. It was not a goal of the project to quantify sources under wet or dry conditions separately, due to budget limitations.

While the sampling approach was intended to include some samples under rainfall runoff conditions, it should be recognized that it is difficult to gauge the extent of impact of rainfall runoff in reservoirs when there is often no measurable change in flow. The occurrence of rainfall across each watershed and the magnitude and intensity of rain required to generate runoff is quite variable. Thus it was difficult to define a runoff-influenced sampling event based on rainfall data alone. For this project a runoff-influenced sampling event is based on elevated flow in the Leon River at Gatesville and the North Bosque River at Valley Mills, and as such only one of the 10 sampling events (November) was strongly influenced by runoff on the day samples were collected. During the March sampling event, the rivers exhibited a minor increase in flow in response to rainfall, and elevated suspended solids and *E. coli* concentrations imply the likely influence of runoff, but it is not clear that a strong runoff influence was present. Finally, a major rainfall event occurred two days before the January sampling event, and river flow had returned to near pre-storm levels during sampling. Water quality in the rivers also appeared to have returned to pre-runoff conditions on this sampling date, but in the lakes elevated suspended solids and *E. coli* concentrations implied that some influence of runoff persisted there.

Because *E. coli* populations have been found to vary on fine spatial and temporal scales, five independent water samples were collected at each station and event, 1-2 minutes and 3-10 feet apart, to increase the representativeness of natural conditions by the sampling. Typically, this was done by sampling five points evenly spaced around the perimeter of a boat. At the two stations near the dams (11942 in Lake Waco and 11921 in Belton Lake) and in drinking water intakes of Lake Waco and Belton Lake, the samples were collected in duplicate for a total of 10 samples per event.

Table 3-1 Sampling Sites

Station ID	Station Description	Sampling Events, Frequency
11942	Lake Waco near dam	10, monthly
11945	Lake Waco North Bosque Arm	10, monthly
11948	Lake Waco Middle/South Bosque Arm above state highway (SH) 6	10, monthly
TBD3	Lake Waco Middle/South Bosque Arm near inlet of Middle/South Bosque River	10, monthly
11953	North Bosque River at SH 56 near Valley Mills	10, monthly
11956	North Bosque River at farm to market (FM) 219 northeast of Clifton	10, monthly
11921	Belton Lake near dam	10, monthly
11922	Belton Lake Cowhouse Creek Arm	10, monthly
11923	Belton Lake Leon River Arm near headwater	10, monthly
TBD4	Belton Lake Owl Creek Arm	10, monthly
11925	Leon River at FM 1829 southeast of North Fort Hood	10, monthly

Water samples were collected directly from the lake or stream (approximately 1 foot below the surface) into sterile wide-mouthed polypropylene bottles supplied by the City of Waco laboratory. Care was exercised to avoid the surface microlayer of water, which can be enriched with bacteria and not representative of the water column. Field staff wore clean, disposable, powder-free gloves while collecting all samples. Blank samples were collected at a rate of one per 10 ambient samples to verify that no contamination took place. Upon collection, all water samples were placed in an iced container and transported to the City of Waco laboratory for analysis within 6 hours. A table summarizing the sampling results for each water quality monitoring station is provided in Appendix A.

Figure 3-1 Water Quality Monitoriug Stations on Lake Waco and the North Bosque River

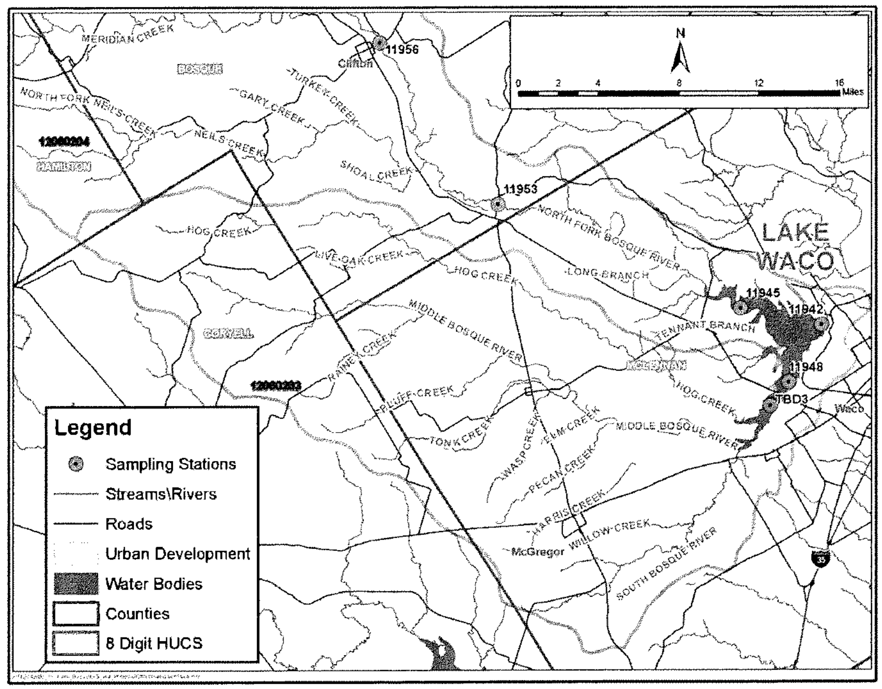

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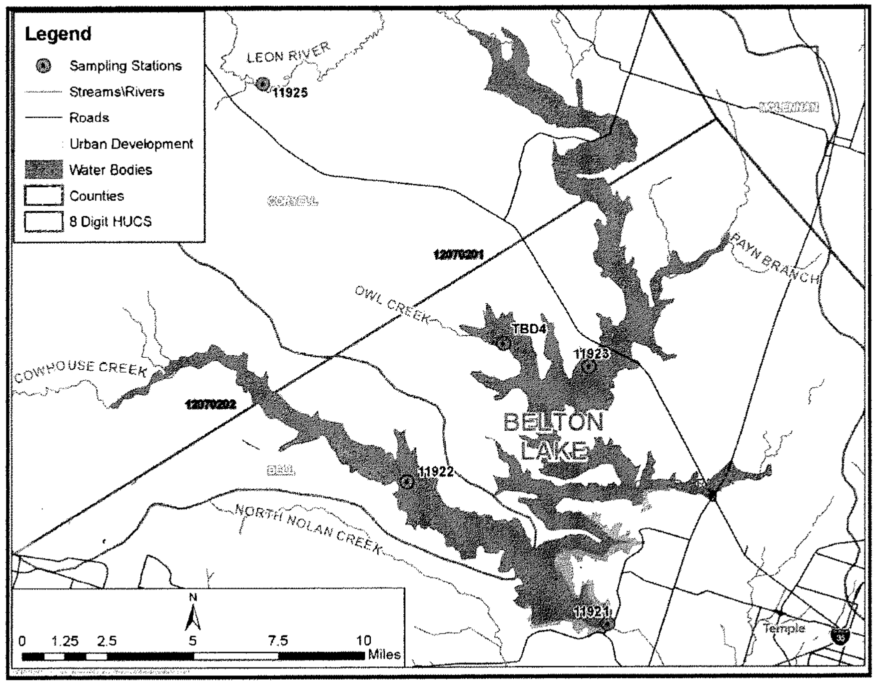
Figure 3-2 Water Quality Monitoring Stations on Belton Lake and Leon River



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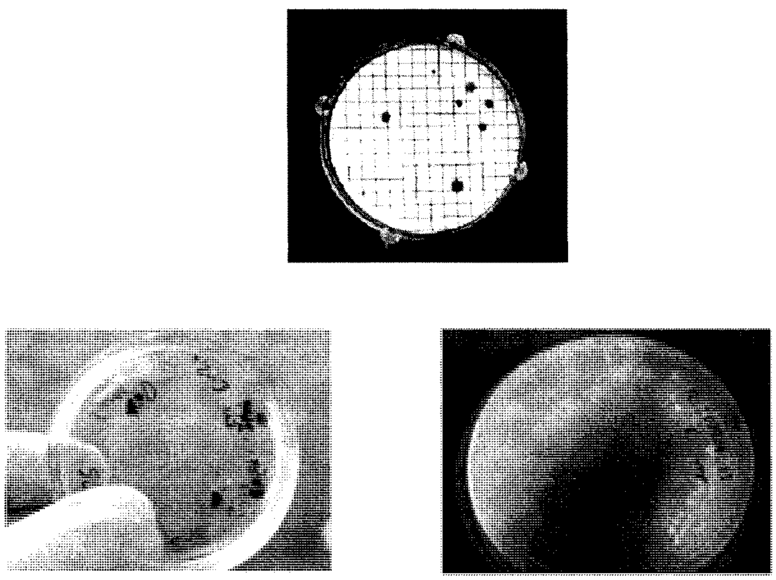
3.2 ISOLATION AND CONFIRMATION OF *E. COLI* FROM WATER

Following collection, water samples were delivered to the City of Waco Laboratory for *E. coli* culturing and enumeration via the membrane filter modified mTEC method. A 6-hour holding time for sample delivery to the laboratory and initiation of analysis was maintained. Following incubation and enumeration using USEPA Method 1603, the modified mTEC plates with *E. coli* colonies were shipped on ice overnight to the BST laboratory at EP AREC for *E. coli* isolation, confirmation, and archival. Figure 3-3 displays examples of the filters and plates used for isolation of *E. coli* colonies. *E. coli* colonies from the modified mTEC plates were picked and streaked for purity on nutrient agar with MUG (NA-MUG) to confirm glucuronidase activity and culture purity.

Figure 3-3 Isolation of *E. coli* from Water Samples



A sample processing protocol for isolation and confirmation of *E. coli* isolates from water samples is included as Appendix B. Table 3-2 provides a summary of the number of unknown isolates successfully archived from the 11 different water quality monitoring stations.

Table 3-2 Summary of Unknown Isolates from Water Quality Samples

Station ID	Station Description	Number of Water Samples Collected	Number of *E. coli*-positive Samples Sent to EP AREC	Number of *E. coli* Isolated From Samples	Number of *E. coli* Analyzed by All Four Methods
11942	Lake Waco near dam	100	74	75	67
11945	Lake Waco North Bosque Arm	50	43	63	57
11948	Lake Waco Middle/South Bosque Arm above SH 6	50	43	52	45
TBD3	Lake Waco Middle/South Bosque Arm near inlet of Middle/South Bosque River	50	45	64	54
11953	North Bosque River at SH 56 near Valley Mills	50	22	65	53
11956	North Bosque River at FM 219 northeast of Clifton	50	35	84	72
11921	Belton Lake near dam	100	31	29	27
11922	Belton Lake Cowhouse Creek Arm	50	17	24	24
11923	Belton Lake Leon River Arm near headwater	50	30	49	44
TBD4	Belton Lake Owl Creek Arm	50	32	50	42
11925	Leon River at FM 1829 southeast of North Fort Hood	50	40	76	70
	TOTALS	**650**	**412**	**631**	**555**

SECTION 4
E. COLI KNOWN SOURCE LIBRARY DEVELOPMENT

4.1 COLLECTION, ISOLATION, AND CONFIRMATION OF *E. COLI* FROM KNOWN SOURCES

The BST techniques used in this study are library-dependent. Therefore, it was necessary to construct reference libraries of genetic and phenotypic fingerprints for *E. coli* isolated from known sources (*e.g.*, domestic sewage, livestock, and wildlife) derived from each watershed. By matching the fingerprints of *E. coli* isolated from water samples with the fingerprints in the known source libraries, the likely animal or human (domestic sewage) fecal sources of surface water contamination can be determined.

BST investigators recognize two major considerations when developing source libraries: representativeness and library size. A source library should be representative of the different potential human and animal sources of fecal contamination for the watershed, as well as represent the genetic diversity of the target organism population (in this case *E. coli*) from these different sources. Library size can have an effect on the accuracy of source tracking results, although there is currently no consensus among BST investigators on how to determine the appropriate size of a library. Many genetic-based studies have used relatively small libraries of approximately 35 to 500 source isolates, while many phenotypic-based studies have used larger libraries of approximately 1,000 to 6,000 isolates (Johnson, *et al.* 2004). Genetic-based (genotype) approaches rely on molecular methods used to analyze deoxyribonucleic acid (DNA). Phenotypic-based approaches rely on biochemical methods to identify different reactions by bacteria from different sources. Small libraries may have difficulty identifying environmental isolates, while some of the larger libraries used in prior studies included numerous isolates from the same source sample (many likely identical strains, referred to as "clones"), which may have introduced statistical bias in cross-validation evaluation of the library sensitivity and specificity. Also, depending on the statistical algorithms used for identifying unknowns, large libraries may confound identification.

The primary sampling design consideration for this BST study was to obtain as many unique *E. coli* library isolates as possible from individual animals or samples to represent the diversity and abundance of fecal contamination sources occurring in Lake Waco and Belton Lake watersheds. Budget and time constraints limited library size to approximately 1,000 unique *E. coli* to be isolated from approximately 1,000 different source samples, a moderately large library and high number of source samples. Potential fecal sources were identified through a sanitary survey conducted by Parsons. Municipal wastewater treatment plant influent/effluent and septage samples (collectively referred to as "domestic sewage"), livestock, wildlife, and pet fecal samples, were obtained from a variety of sources throughout the Lake Waco and Belton Lake watersheds based on the sanitary survey. The known source samples collected from the two watersheds and used to establish the local library are summarized in Appendix C.

To the extent possible, known source samples were collected directly from the source feces. An exception was the domestic sewage samples collected from wastewater treatment plants and septic tanks, as opposed to individual human samples. In some cases, wildlife samples had to be collected indirectly from "found" fecal samples. The sources of these "found" wildlife fecal samples were identified to the lowest practical taxonomic level by experienced field biologists. No samples of uncertain sources were used for library development. Only a single sample was collected from an individual animal. Fresh animal fecal samples were collected aseptically, using a sterile spatula or swab, into sterile, screw-cap polypropylene specimen tubes. Samples were kept on ice and shipped overnight to the EP AREC laboratory for isolation of *E. coli*. Source samples were collected over a 13-month period, from October 2003 to October 2004.

Another important consideration for source tracking studies is the method used to isolate target organisms from water and source samples (USEPA 2005). Since *E. coli* was the target organism in this study and the basis of a regulatory water quality standard, a USEPA-approved method for monitoring this organism in water was used (USEPA 2002). This was important from a regulatory perspective as well as from a scientific one. Historically, microbiologists have known that the culture medium used to isolate bacteria has a significant effect on the types and diversity of the organisms recovered. For example, the types of *E. coli* isolated from source fecal specimens using clinical media may be different from the types of *E. coli* isolated from water using regulatory testing media. In this study, this potential problem was minimized by using the same medium, modified membrane thermotolerant *E. coli* agar (modified mTEC), for the isolation of *E. coli* from source and water samples.

Fecal specimens or domestic sewage samples were streaked (resuspended in buffer if necessary) onto modified mTEC medium, a selective and differential medium for *E. coli*, which is the basis for USEPA Method 1603 detection of *E. coli* in water (USEPA 2002). Inoculated plates were incubated at 35±0.5°C for 2 hours to resuscitate stressed bacteria, then incubated at 44.5±0.2°C for approximately 20-24 hours. The modified mTEC method is a single-step method that uses one medium and does not require testing using any other substrate. The modified medium contains the chromogen 5-bromo-6-chloro-3-indolyl-β-D-glucuronide (Magenta Gluc), catabolized to glucuronic acid, and a red/magenta-colored compound by *E. coli* that produces the enzyme β-D-glucuronidase. This enzyme is the same enzyme tested for using other substrates such as the fluorogenic reaction with 4-methylumbelliferyl-β-D-glucuronide (MUG) observed using UV fluorescence in other *E. coli* assays (*e.g.* IDEXX Colilert and QuantiTray). At least two attempts to isolate *E. coli* were made before considering the sample negative for *E. coli*. *E. coli* colonies from the modified mTEC medium were picked and streaked for purity on nutrient agar with MUG (NA-MUG) to confirm glucuronidase activity and culture purity. A sample processing protocol for isolation and confirmation of *E. coli* from known fecal samples is included as Appendix D.

Between October 2003 and October 2004, a total of 994 fecal samples were collected from known sources. A significant number of these samples did not yield suitable *E. coli* isolates, either because of shipping problems, because no *E. coli* could be recovered from the samples, or because of non-specific or non-*E. coli* bacterial growth on modified mTEC plates from sewage samples. An additional 100 *E. coli* isolates from south Texas non-avian wildlife from a previous BST study were also included (Mott and Lehman 2001).

A total of 813 *E. coli*-positive samples were obtained, with one to three *E. coli* isolates from each samples screened by ERIC-PCR. Some isolates could not be analyzed using PFGE which resulted in the exclusion of 68 samples. In all, 2,275 *E. coli* isolates from source samples were screened by ERIC-PCR. After excluding clonal isolates, one to three isolates per sample (745 samples) for a total of 883 isolates were selected for the library and analyzed by all four BST methods. Table 4-1 provides a summary of samples, *E. coli* isolated from those samples, and total numbers of samples and isolates included in the source library.

4.2 ARCHIVAL OF ISOLATES

Typically one to five *E. coli* isolates were archived for each source sample, while one to 12 isolates per water sample were archived. All additional isolates were archived in the event some isolates did not freeze well or additional isolates for analysis might be required at a later date. Due to the relatively low number of *E. coli* positive samples obtained from water, all the archived isolates were subsequently analyzed. Well-isolated colonies of *E. coli* cultured overnight on either NA MUG or brain heart infusion agar (BHI, the medium used for the DuPont Qualicon RiboPrinter Microbial Characterization System) were resuspended in tryptone soy broth (TSB) with 20 percent glycerol in cryovials and stored at -70 to -80°C. Frozen cultures of selected isolates were provided to the TAMU and TAMU-CC laboratories. A sample processing protocol is included as Appendix E. These frozen cultures can remain viable for years and can be easily shared with other researchers.

4.3 SCREENING OF KNOWN SOURCE *E. COLI* USING ERIC-PCR FOR LIBRARY CONSTRUCTION

As mentioned previously, if identical strains (clones) of *E. coli* from the same sample are included in a BST library, statistical bias may occur, leading to inflated estimates of method performance. A common method of evaluating BST libraries is jackknife analysis. The jackknife analysis used in this study involved pulling each library isolate one-at-a-time from the library and treating each as an unknown to determine the percentage of isolates correctly identified to the true host source. This is referred to as the rate of correct classification (RCC). An example of the statistical bias which may occur for a library containing clones is that isolates will frequently match back to a clone from the same sample, inflating the RCCs. In this study, diversity of the *E. coli* isolates in the library was maximized to increase the likelihood of identifying *E. coli* isolated from water samples. This was accomplished by collecting and analyzing high numbers of known source samples collected from individual animals and selectively including only one to three *E. coli* isolates per sample in the library.

Table 4-1 Summary of Known Source *E. coli* Isolates Used for Library Construction

Source Samples	Desired Number of Samples	Number of Samples Collected	Number of *E. coli*-positive Samples	Number of *E. coli* Isolated and Archived From Samples	Number of *E. coli* Screened by ERIC-PCR	Number of *E. coli* Identified for Library by ERIC-PCR	Number of *E. coli*-positive Samples Used for Library	Number of *E. coli* Isolates in Library (Analyzed by All Four Methods)
Domestic sewage	240	294	186	803	624	229	184	226
Pet	85	56	35	140	95	44	33	42
Cattle	150	173	150	657	440	170	130	147
Other livestock avian	20	23	21	92	59	28	19	25
Other livestock non-avian	108	115	97	413	284	112	79	89
Wildlife avian	191	195	121	559	371	163	111	145
Wildlife non-avian†	306	238	203	567	402	234	189	209
TOTALS	**1100**	**1094**	**813**	**3231**	**2275**	**980**	**745**	**883**

† *Includes 100 South Texas wildlife isolates from a previous BST study (Mott and Lehman 2001).*

4.4 EXCLUSION OF IDENTICAL (CLONAL) *E. COLI* ISOLATES FROM THE SAME KNOWN SOURCE SAMPLE

E. coli isolates from known source samples were screened using a repetitive sequence polymerase chain reaction method (ERIC-PCR). ERIC-PCR is a genetic fingerprinting method used in previous BST studies as well as many microbial ecology and epidemiological studies. ERIC elements are repeat DNA sequences found in varying numbers and locations in the genomes of different bacteria such as *E. coli*. The PCR is used to amplify the DNA regions between adjacent ERIC elements. This generates a DNA banding pattern or fingerprint which looks similar to a barcode pattern. Different strains of *E. coli* bacteria have different numbers and locations of ERIC elements in their bacterial genomes, and therefore, have different ERIC-PCR fingerprints. ERIC-PCR was chosen as the screening technique because of its moderate cost and moderately high ability to resolve different strains of the same species of bacteria. A sample processing protocol for ERIC-PCR is included in Appendix F.

In general, three *E. coli* isolates from each known source sample were fingerprinted using ERIC-PCR. BioNumerics software (Applied Maths, Austin, TX) was used to analyze the ERIC-PCR fingerprints, as well as the other BST data for this project. First, the ERIC-PCR fingerprints obtained from each isolate from a sample were compared to each other using the densitometric curve-based Pearson-product similarity coefficient. An 80 percent similarity cutoff was used, and isolates having more than an 80 percent similarity were considered identical (clones). This similarity cutoff was based on preliminary analysis of replicate ERIC-PCR fingerprints for laboratory QC isolates which were found to be reproducible with approximately 85% similarity. The number of different ERIC-PCR types represented by the isolates from a single sample was determined. A total of 2,275 *E. coli* isolates were screened using ERIC-PCR. A sample processing protocol is included as Appendix G.

4.5 SELECTION OF ISOLATES FOR THE LIBRARY

After determining the number of different *E. coli* ERIC-PCR types and clones for a sample, one to three isolates per sample were selected for inclusion in the library. Isolates representing the different ERIC-PCR types identified for each sample were compared to the *E. coli* isolates selected from other samples for the source library at the time. The same similarity cutoff of 80 percent was used, and isolates having a more than an 80 percent similarity to an existing library isolate were considered already represented in the library, without regard to source. Each isolate from a single known source sample that was novel (<80% similarity) compared to the library isolates was then selected for inclusion in the library. Also, if an isolate had more than an 80 percent similarity to only a single library isolate, then it was also selected for the library, regardless of the selection of other isolates from the same sample. Therefore, clusters were composed of isolates from different samples.

At least one *E. coli* isolate from each known source sample was included in the library. If all ERIC-PCR types represented by the isolates from a single sample were already present in the library, then an isolate representing the most abundant (and as such being the most representative) ERIC-PCR type for that sample was selected for the library. Therefore, abundant/common strains of *E. coli* isolates from different samples and animals were represented in the library. If isolates were equally abundant in a sample, then the isolate that best filled in the tree was selected. Building the library was a dynamic process; isolates were added to the library as their ERIC-PCR patterns were processed.

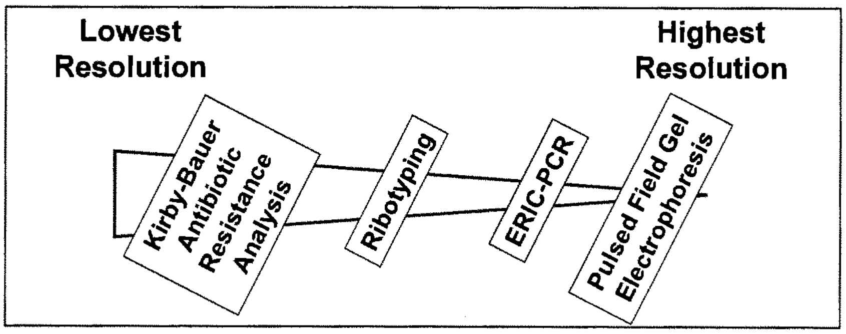
In addition, 100 *E. coli* isolates from known wildlife sources obtained in a previous BST study in south Texas were characterized and included in the library (Mott and Lehman 2001). This not only helped to increase the diversity of wildlife *E. coli* isolates included in the library, which often can be difficult to obtain, but also helped to make progress toward development of a statewide library. A total of 980 *E. coli* isolates were identified for inclusion in the library using ERIC-PCR. Of these 980, 883 isolates from 745 source samples were successfully analyzed by the four BST methods described in Section 5 and were used to construct the source library (Table 4-1).

SECTION 5
DESCRIPTION OF BST METHODS

Of the molecular tools available, ribotyping and PFGE DNA fingerprinting are recognized as promising BST techniques. A phenotypic (non-genetic) characterization method, Kirby-Bauer antibiotic resistance analysis (KB-ARA), also has the potential to identify the human or animal origin of *E. coli* isolates. Currently, there is still no consensus among BST researchers as to the single most useful BST method.

All methods selected for this project were used in previous BST studies, as well as other microbiological studies, and have been published in peer-reviewed journals. They span the spectrum in their ability to resolve differences in related bacterial strains, technical training and labor required, equipment cost, reagent cost, sample throughput, and ease of data analysis. Figure 5-1 displays a conceptual sensitivity continuum of the BST methods used in this study. Phenotypic based methods are at the less sensitive domain of the continuum, while genotypic based methods constitute the more sensitive end of the spectrum.

Figure 5-1 Discriminatory Capabilities of Different BST Methods



In this study, the combination of the DuPont RiboPrinter System, PFGE, ERIC-PCR, and KB-ARA allowed evaluation and development of one of the most comprehensive *E. coli* BST libraries and one of the first side-by-side comparisons of these BST methods. Recent BST studies also suggest that a combination of complementary methods may be the best approach for accurately identifying sources of contamination.

The validity of this study and the conclusions drawn from the results are strengthened through the use of the multiple techniques, and in particular, composite data sets. Further, by using standardized methods, the library can be expanded through future projects and the data shared with other BST investigators and regulatory agencies. Peer-reviewed publication of project results is also a goal, and journal manuscripts are being prepared as of the date of this report.

5.1 RIBOTYPING

Ribotyping is a genetic fingerprinting method used in previous BST studies as well as many microbial ecology and epidemiological studies, although there is not a consensus as to the best protocol. In general, an endonuclease enzyme (*Hind* III) selectively cuts *E. coli* DNA wherever it recognizes a specific DNA sequence. The resulting DNA fragments are separated by size and probed for fragments containing particular conserved ribosomal RNA gene sequences, which results in DNA banding patterns or fingerprints that look similar to barcode patterns. Different strains of *E. coli* bacteria have differences in their DNA sequences and different numbers and locations of enzyme cutting sites, and therefore have different ribotyping fingerprints.

By automating the process, the DuPont Qualicon RiboPrinter Microbial Characterization System can analyze up to 32 samples per day, whereas manual ribotyping methods may require up to several days to complete. All bacterial isolate sample processing is automated using standardized reagents and a robotic workstation, providing a high level of reproducibility. The RiboPrinter was originally developed for use in identification and BST of microbial isolates for the food industry. Since the system employs standardized methods and reagents, results obtained from other laboratories using the system are directly comparable. RiboPrinting has a moderate ability to resolve different strains of the same species of bacteria. Although the automated system saves time and requires little training, the initial investment and the processing cost per isolate are expensive. A sample processing protocol for RiboPrinting is included in Appendix H.

5.2 PULSED FIELD GEL ELECTROPHORESIS

Pulsed-field gel electrophoresis (PFGE) is another leading genetic fingerprinting method used in BST. The entire bacterial genome is fragmented using an infrequent cutting restriction endonuclease enzyme (e.g. *Xba* I) which cuts DNA wherever it recognizes a specific rare sequence. All the DNA fragments are separated by size and visualized resulting in a genetic fingerprint that resembles a barcode. Different strains of *E. coli* bacteria have differences in their DNA sequences and different numbers and locations of enzyme cutting sites and therefore, have different PFGE fingerprints.

PFGE is currently being used by the Centers for Disease Control and Prevention (CDC) to track foodborne *E. coli* O157:H7 and *Salmonella* isolates. TAMU Food and Environmental Microbiology Laboratory followed the standardized CDC protocol using *Xba* I for PFGE analysis of *E. coli* in this BST study. CDC currently uses this standardized protocol as the basis of their "PulseNet" outbreak surveillance network which allows public health laboratories nationwide to quickly compare their PFGE fingerprints to the CDC central reference library. A sample processing protocol is included in Appendix I.

Although it requires more training and cost, PFGE has very high resolution and can discriminate between closely related strains. While this allows higher confidence in the matches made, fewer identifications can be made, even with lower similarity cutoffs. In addition, some bacterial strains have genomic DNA in configurations that do not permit effective restriction endonuclease digestions. The inability to obtain patterns from replicates implies there is an issue at the organism/genome level rather than the procedure. It should be noted that PFGE patterns could not be generated for approximately 10 percent of the known library isolates and water isolates, limiting the number of isolates that could be analyzed by all four methods from 980 to 883 library isolates, and from 631 to 555 unknown water isolates.

5.3 ENTEROBACTERIAL REPETITIVE INTERGENIC CONSENSUS POLYMERASE CHAIN REACTION (ERIC-PCR)

ERIC-PCR was described in Section 4. A sample processing protocol for ERIC-PCR is included in Appendix F.

5.4 KIRBY-BAUER ANTIBIOTIC RESISTANCE ANALYSIS

The KB-ARA method was performed by the TAMU–CC Environmental Microbiology Laboratory. This technique followed methods used in the clinical laboratory for evaluating the antibiotic resistance of bacterial isolates. Commonly, the disk diffusion method is used which involves measuring the diameter of the zone of inhibition of bacterial growth around a filter disk impregnated with a specific antibiotic. By comparison to resistant and susceptible control strains, the response of the *E. coli* isolates can be determined. To further standardize and automate the assay, an image analysis system was used to measure the zones of inhibition and provide electronic archival of data. The KB-ARA profile for an isolate consists of the measurements of the zones of inhibition in response to 20 antibiotics, each at a standard single concentration. Discriminant analysis is the standard statistical analysis tool for KB-ARA results. A sample processing protocol is included as Appendix J.

Of the four methods applied in this study, KB-ARA has the lowest ability to discriminate closely related bacterial strains. However, it also has the lowest initial and per sample cost and takes the least time and training, although the statistical analysis can be complex.

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SECTION 6
BST DATA PROCESSING AND ANALYSIS USING BIONUMERICS

BioNumerics software (Applied Maths, Austin, TX) was used to analyze the BST data for this project. This software is currently used in many BST studies, especially for molecular fingerprint methods. For this project, BioNumerics was used in three ways: 1) processing gel images, 2) determining the relationships between the isolates by comparing their molecular fingerprint patterns for development of the BST libraries, and 3) for identification of water isolates.

6.1 GEL ELECTROPHORESIS IMAGE PROCESSING

Once the ERIC-PCR and PFGE gels were completed, digital photos were taken of the gels containing fingerprints of the isolates. The digital images were then processed using BioNumerics software in a four-step procedure. First, the area of the gel image and the individual lanes were defined. Second, spectral analyses of the densitometric curves were optimized. Third, the marker lanes were defined and normalized, and fourth, the fingerprint was linked to the isolate-designated key in the BioNumerics database. RiboPrints were partially processed by the Qualicon software and were imported into BioNumerics using the Load Samples Amplified script from DuPont Qualicon.

6.2 CORRELATION COEFFICIENTS, MATCHING CRITERIA

The curve-based Pearson-product similarity coefficient allowed for both the position and the relative intensity of the fingerprint bands to be considered in the comparisons, not just the presence or absence of a band (*i.e.* band-matching). From these comparisons, dendrograms (or family trees) were constructed using the unweighted pair group method with arithmetic means (UPGMA) to depict the relationships between the isolates.

An epidemiological-like approach (*i.e.* one-to-one matching) was used for each of the molecular techniques to find the best match of an unknown isolate's fingerprint to the fingerprint of a single library isolate. To accomplish this, the BioNumerics Best Matches script provided by Applied Maths was used. A fingerprint was not considered a match unless it was at least 85 percent similar to another single entry for the ERIC-PCR and RiboPrinting techniques, or 70 percent for the PFGE fingerprint. This similarity cutoff was based on reproducibility of the fingerprint obtained with the *E. coli* QC101 strain (RiboPrinter System QC strain). Repeated analyses of the *E. coli* QC101 strain were run at approximately once per ERIC-PCR or PFGE batch/gel or daily for the RiboPrinter. Densitometric Pearson-product coefficient matching is so stringent that it is essentially not possible for two different molecular fingerprints to be 100 percent identical. It should be noted that fingerprints, for example RiboPrint patterns, greater than 85 percent similar as determined by Pearson-product coefficient matching, often appear identical to the naked eye.

6.3 COMPOSITE DATA SETS

Fingerprint patterns were compared individually for each of the molecular methods (ERIC-PCR, RiboPrinting, and PFGE) using the BioNumerics software as described above. An equivalent comparison of the KB-ARA profile treated the zone of inhibition measurements for each of the 20 antibiotics as character data to compare isolate profiles using the BioNumerics software. While KB-ARA usually uses discriminant analysis to identify sources of isolates in a population biology approach (see below), KB-ARA data were also analyzed using BioNumerics and the Pearson-product coefficient.

BioNumerics has the unique ability to allow the construction of composite data sets. A composite data set takes into account all four fingerprint profiles (ERIC-PCR, RiboPrint, PFGE, and KB-ARA), or various combinations of profiles for each isolate. Each BST method describes a different trait or aspect with different degrees of resolution or discrimination. An analogy would be the composite sketch of a suspect gathered from the descriptions of eye-witnesses to a crime, each having a different perspective.

To incorporate all four BST methods, BioNumerics was used to calculate a composite data set using the unweighted averages of the individual method similarity matrices, resulting in a new, single similarity matrix which incorporates attributes of each individual method. Composite data sets for only known library isolates and water isolates that had patterns for all four BST methods were created. Since some isolates were not amenable to PFGE and did not generate a fingerprint with this method, this reduced the number of composite data set library source isolates from 980 to 883, and the number of water isolates from 631 to 555. The similarity cutoff used for comparing composite set data was 70 percent to allow for variation of the individual methods. This similarity cutoff was confirmed by calculating the rates of correct classification for the library source isolates, and discerning where there were fewest cross-identifications balanced with the number of water isolates that would be left unidentified (Table 6-1).

Although fingerprint profiles are considered a match to a single entry, identification is to the host source class, and not to the individual animal represented by the best match. Host sources were divided into seven groups, 1) domestic sewage; 2) pet; 3) cattle; 4) other livestock, avian; 5) other livestock, non-avian; 6) wildlife, avian; and 7) wildlife, non-avian. The division of host sources into these particular classes was based on discussion with project participants and anticipated usefulness for the development of BMPs.

Table 6-1 Comparison of Similarity Cutoffs for the Four-Method Composite Data Set and Effect on Library RCC and Percentage of Source and Water Isolates Left Unidentified

4-Method composite data set	Percent unidentified water (555)*	Domestic sewage (226)		Pet (42)		Cattle (147)		Other livestock, avian (25)		Other livestock, non-avian (89)		Wildlife, avian (145)		Wildlife, non-avian (209)	
Similarity cutoff		% RCC	% no ID	% RCC	% no ID	% RCC	% no ID	% RCC	% no ID	% RCC	% no ID	% RCC	% no ID	% RCC	% no ID
65%	3	83	6	30	5	60	1	21	4	39	1	49	6	65	7
70%	9	83	15	33	14	61	3	22	8	40	8	48	11	66	11
75%	24	84	30	36	33	64	15	29	44	43	22	52	29	70	22
80%	56	91	48	44	57	66	46	11	64	56	54	62	48	73	41

**Number of isolates in parentheses*

*** % no ID = percentage of isolates in the source class that were below the similarity cutoff and were therefore left unidentified*

6.4 DISCRIMINANT ANALYSIS

Discriminant analysis is a commonly used approach for analysis of antibiotic resistance profiles. Discriminant analysis is a multivariate technique that can be used to classify items into categories based on a set of test variables. The RCC for each source can be used to evaluate the predictive capabilities of the database. Additional analyses can use step-wise methods such as Wilks' lambda and Mahalanobis' distance as alternatives to remove variables which do not contribute or contribute little to the classification, in order to improve the ability to correctly classify sources. As classifications based upon the cases used to create the model tend to be too "optimistic" in the sense that their classification rate is inflated, cross-validation is performed by classifying each case while leaving it out from the model calculations (leave-one-out method); however, this method is generally still more "optimistic" than subset validation. Subset validation can be performed using the holdout method.

In this study, discriminant analysis was performed on antibiotic resistance zone of inhibition diameters of each isolate. The zone diameters were compiled into a library of known sources to be analyzed using discriminant analysis with SPSS™ Version 12.0 for Windows™, following the SPSS Base 9.0 Applications Guide, SPSS Online tutorial, and Discovering Statistics using SPSS for Windows.

SECTION 7
EVALUATION OF BST TECHNIQUES

7.1 PRECISION AND ACCURACY OF TECHNIQUES

Precision is a measure of the reproducibility of the methods using replicates. Accuracy reflects the truth of the identification of an isolate. Both precision and accuracy were tested in the routine laboratory controls, as well as a special blind quality control (QC) study performed as described below.

7.2 LABORATORY CONTROLS

Standard laboratory practices were followed to assure quality data. All data obtained from field and laboratory measurements were reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements. Each laboratory method included additional required QC measures. Quality control for the molecular techniques (ERIC-PCR, RiboPrinting, and PFGE) was achieved by using a QC strain of *E. coli* (*E. coli* QC101, ATCC #51739) provided by DuPont Qualicon for the RiboPrinter System. *E. coli* QC101 was analyzed under the same conditions as the library and water isolates on every ERIC-PCR and PFGE gel over the course of the study. It was also included in one of every four RiboPrinting batches, or each day the RiboPrinter was run. Gels or batches which did not yield typical *E. coli* QC101 fingerprints were not used and prompted a review of procedures, equipment, and supplies to identify and correct any QC issues. Blanks were also included in every batch of ERIC-PCR (and gel) to ensure there was no contaminating DNA in any of the reagents that could be amplified by the PCR. Normal variations in the precision of the fingerprint patterns generated for *E. coli* QC101 over time using the different BST methods were the basis of the matching criteria (similarity cutoffs) for the different methods. For the KB-ARA biochemical method, every tenth isolate was run in duplicate to assure reproducible profiles.

7.3 BLIND QC STUDY

BST does not lend itself easily to the same QC methods as chemical quantification because each measurement is essentially qualitative, not quantitative. Blank samples are less relevant, and replicate water samples may often yield different *E. coli* strains. Therefore, in this study laboratory method accuracy and precision were quantified through a special QC study with blinded safeguards. The TSSWCB project manager used a random number generator to select 60 isolates from a list of 1,024 different known source isolates (980 *E. coli* and 44 confounding isolates) collected in the Lake Waco and Belton Lake watersheds as part of this study, and previously studied south Texas wildlife isolates. From the list of 60, the TSSWCB project manager narrowed the list down to 30 by eliminating many duplicate species and ensuring that the percentage of domestic sewage isolates was similar to the percentage of this source class in the total library. The list of the 30 selected isolates was provided to EP AREC, and triplicate cultures of each isolate were prepared and sent to the Parsons project manager. The Parsons project manager selected 10 of the 30 isolates, blind labeled them, and sent the triplicate cultures of each to the BST labs. The samples were processed through the PFGE, RiboPrinting, ERIC-PCR, and KB-ARA procedures in a blind fashion; that is, the laboratories did not know the sources. Each lab attempted to identify the 10 sets of triplicates, identify the triplicates to the correct library isolate (of the 30 possible), and to the correct source class. After each lab reported its individual results to the TSSWCB project manager, the labs shared their raw data with EP AREC for composite data set analysis. After EP AREC reported the composite data set results to the TSSWCB project manager, the key of the blind isolates was provided to all participants. Identifications were based on best matching and dendrograms for the three molecular methods and composite data sets, while the KB-ARA data were analyzed using discriminant analysis.

It should be noted that the ERIC-PCR, RiboPrinting, PFGE, and composite data set results were based on best matching to the QC library of 30 possible isolates, as well as visual inspection of the similarity dendrograms and subjective judgment. Fingerprints for the unknown QC isolates were grouped in their own dendrogram to identify the triplicates. Identification of the replicates was relatively straightforward for the ERIC-PCR, PFGE, and the composite data set, but was more complex for RiboPrinting data. The dendrogram was used, as well as a process of elimination. To identify the unknown isolates, their patterns were compared to the 30 QC library isolates used in the study.

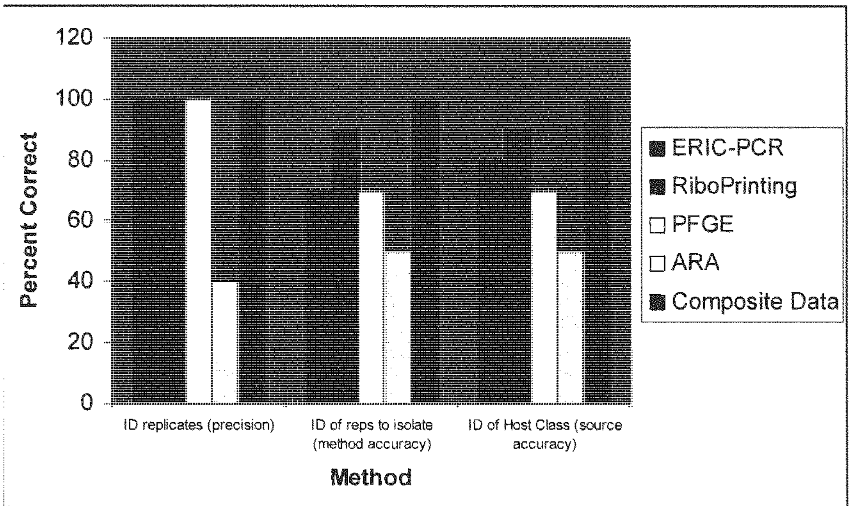
Note that PFGE fingerprints could not be generated for four of the 30 possible QC library isolates, and by chance two of these were used as blind challenge isolates. Since they could not be included in the PFGE QC library and identification was not possible with this method, PFGE was not penalized for its inability to identify these isolates.

It should also be noted that the QC study design was more suitable for the genetic analyses, where one-to-one matching of fingerprints is performed, than for the KB-ARA method using discriminant analysis. The KB-ARA profiles for the isolates selected for the QC study were not distinct enough to easily distinguish or group the isolates into the three replicates. KB-ARA is generally used to classify isolates into categories rather than individual species sources. The identifications and groupings were based on discriminant analysis and visual comparisons of the zone diameter data and subjective judgment. However, using single isolates makes discriminant analysis statistically inappropriate.

Overall, the ERIC-PCR, RiboPrinting, and PFGE techniques performed equally well, with 100 percent identification of replicate isolates (precision) and 70 to 90 percent accuracy in identification of replicate isolates to specific QC library isolate (method accuracy) and correct source class (source identification accuracy) (Figure 7-1). On the other hand, the KB-ARA scored only 40 percent for identification of replicate isolates (precision) and 50 percent for method and source identification accuracy, likely due to the reasons given above.

Most important, however, are the four-method composite data set results. The composite data set results correctly identified 100% of the replicate QC cultures (precision), and had 100% accuracy for *E. coli* strain and source class identification of the isolates. Therefore, the composite four-methods performed better than any single method.

Figure 7-1 Blind Quality Control Study Results



7.4 LIBRARY EVALUATION

7.4.1 Jackknife Analyses of Each BST Method

Jackknife analysis is treating each known library isolate as if it were an unknown by trying to identify it against the rest of the library. By comparing the true identities to the given identities, the RCCs can be calculated. The RCC is the percentage of library isolates correctly identified back to their source out of the number of attempts made to identify isolates from that source. Isolates which are left unidentified are not directly reflected in the RCC calculation. While there is no agreement as to the minimum acceptable RCC, the rates should at least reflect a better than random chance of source class identification. Some factors are known to confound the calculation. Inclusion of bacterial clones from the same sample can artificially inflate the RCC, while large libraries with increased isolate diversity can decrease the RCC and increase the number of isolates left unidentified.

To determine RCCs, matches to host source class were used, as opposed to matches with specific animal species. For example, an isolate from a wild goose matching with an isolate from a wild duck was considered a correct match for the avian wildlife source class. In rare instances (<1%), there were ties for the best match (same percentage of similarity). In these cases, the benefit of the doubt was given and the isolate most similar in host source class was selected as the match.

The RCCs for the individual and four-method composite BST Library of 883 isolates (Table 7-1) were lower than often reported in the literature for BST studies. However, these RCCs are higher than average compared to a recently published extensive and more unbiased comparison of seven different BST protocols (Stoeckel, *et al.* 2004). While perhaps detrimental to the conventional statistical evaluation of BST libraries, moderately large libraries containing diverse isolates, as developed in this study, are more likely to reflect the potential diversity of the unknown water isolates they are meant to identify.

PFGE tended to have the highest RCCs (Table 7-1). However, almost half of the library isolates were left unidentified (*i.e.*, did not match any other library isolate) by the jackknife analyses. Interestingly, RCCs for the KB-ARA data using either best matching or discriminant analysis were fairly similar. The four-method composite data library performed well and had some of the highest RCCs. In particular, the composite library had good RCC values for source classes of special interest: 83 percent for domestic sewage and 61 percent for cattle.

Table 7-1 Jackknife Analysis Rates of Correct Classification (%) for Individual and Composite BST Methods for the 883 Isolate BST Library **

	Random*	PFGE	ERIC-PCR	RiboPrinting	KB-ARA using best matching	KB-ARA using discriminant analysis	Four-method composite data set
Domestic sewage	26	95 (35)**	64 (29)	60 (2)	60 (3)	43 (0)	83 (15)
Pet	5	54 (69)	19 (38)	17 (0)	17 (0)	27 (0)	33 (14)
Cattle	17	80 (60)	46 (13)	43 (4)	41 (0)	27 (0)	61 (3)
Other Livestock avian	3	0 (60)	10 (20)	0 (0)	8 (4)	36 (0)	22 (8)
Other livestock non-avian	10	55 (55)	30 (20)	16 (3)	24 (2)	10 (0)	40 (8)
Wildlife Avian	16	74 (52)	37 (27)	40 (6)	35 (2)	41 (0)	48 (11)
Wildlife Non-avian	24	84 (49)	55 (17)	47 (5)	60 (0)	44 (0)	66 (11)

**Random is the percentage of isolates from each source class represented in the library of 883 source isolates.*

***The number in parentheses is the percentage of isolates for that source class left unidentified after jackknife analyses (<85% similarity for ERIC, RiboPrinting and KB-ARA best match, <70% similarity for PFGE and the composite data set). There is not an unidentified classification or a minimum similarity in discriminant analysis.*

7.4.2 Interpretation of Source Class Cross-Identification of *E. coli* Library Isolates

There will naturally be some *E. coli* isolates that are not host-specific and can come from several host source classes, leading to possible cross-identification to different source classes for these promiscuous isolates. There are two general ways to approach source cross-identification. One is to determine how isolates of a true host source class are identified as reflected in the RCC (as reported above). The second approach is to determine the true identifications of those isolates identified as a particular host source class.

Cross-validation jackknife analysis of the four-method composite data library revealed that, in general, there were low levels of cross-identification for the host source classes (Figure 7-2). For each of the seven source classes, the highest bar within each source class (X-axis) belongs to the correct source and corresponds to the RCC for that particular source class. Only the other livestock avian class had cross-identifications in another single source class (cattle) greater than its correct classification. This may have been due to the low numbers of isolates from this host source class in the library. Also, the attempt to divide livestock into cattle, non-avian, and avian livestock source classes may be a challenge for the number and types of samples collected in this study.

Both correct and cross-identifications are shown, with all columns of the same color adding up to 100 percent of the identification attempts for the library isolates in each source class. The black bars represent the random chance that an isolate would be identified to each source class based on library composition. Cross-identifying isolates were not excluded from the library since a best match algorithm was used.

7.4.3 Library Quality Measures

The four-method composite library was further evaluated for sensitivity and specificity as described in the USEPA *Microbial Source Tracking Guide Document* (USEPA 2005) for both seven-way and two-way splits of source classifications (Tables 7-2 and 7-3, respectively). Sensitivity reflects the percentage of isolates giving a host source-specific fingerprint, and is also referred to as the RCC. Specificity measures how well a BST method can discriminate between source categories. Specificity is determined by performing jackknife analyses, and examining the identifications of known source isolates from other than the respective source. The number of isolates that test negative (or true negatives) and are correctly identified as not belonging to the test source class are divided by the sum of this number plus isolates incorrectly identified to the respective source class (false positives). Although there is no consensus, specificity values below 80 percent are considered of questionable discriminatory power (USEPA 2005). In this study, the four-method composite library specificity values for each source class were all above 80 percent for both the seven-way and two-way split of source classifications.

Figure 7-2 Cross-Validation Jackknife Analysis of the Four-Method Composite Data Library

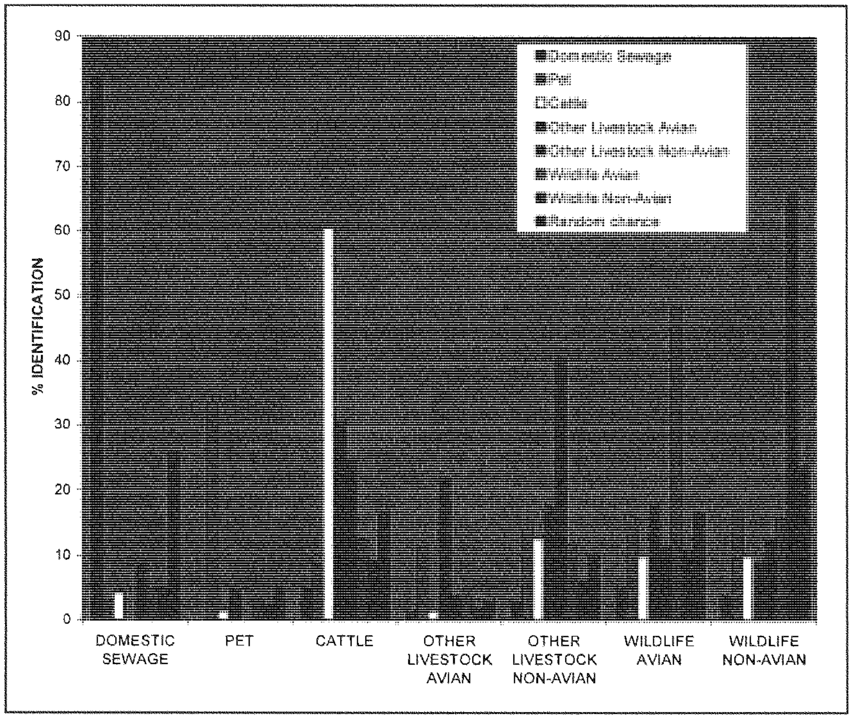


Table 7-2 Quality Measures for the Cross-Validated (Jackknifed) Composite Data Set Library and Seven-Way Split of Source Classes*

	Sensitivity (RCC)	Specificity	Positive predictive value	Random predictive value
	TP/(TP+FN) x 100	TN/(TN+FP) x 100	TP/(TP+FP) x 100	
Domestic sewage	83	95	85	26
Pet	33	99	52	5
Cattle	61	89	54	17
Other livestock, avian	22	97	20	3
Other livestock, non-avian	40	92	36	10
Wildlife, avian	48	91	50	16
Wildlife, non-avian	66	90	68	24

**RCC, rate of correct classification (also known as sensitivity). TP, test positive, isolate correctly identified to its source class; FN, false negative, isolate not identified to its true source class; TN, test negative, isolate correctly identified as not from the particular source; FP, false positive, isolate incorrectly identified as from a given source. The following numbers of isolates that were unidentified after cross-validation analyses (<70% minimum similarity) were not used in these calculations: 34 of 226 Domestic Sewage isolates; 6 of 42 Pet isolates, 4 of 147 Cattle isolates; 2 of 25 Other Livestock, Avian isolates; 7 of 89 Other Livestock, Non-avian isolates; 16 of 145 Wildlife, Avian isolates; and 22 of 209 Wildlife, Non-avian isolates.*

An attempt was also made to calculate the positive predictive values of the four-method composite library for each source class based on seven-way and two-way splits of source classifications. The positive predictive value is the percentage of library isolates identified to a given source class through jackknife analysis that are truly from that source class. Therefore, based on the library characteristics, the positive predictive value provides an estimate of the correct classification of unknown isolates (i.e., the predicted RCC). The random predictive values are based on the composition of the library by percentage of source classes. In all cases the sensitivity (RCC) and positive predictive values are much greater than random chance.

Table 7-3 Quality Measures for the Cross-Validated (Jackknifed) Composite Data Set Library and Two-Way Split of Source Classes*

	Sensitivity (RCC)	Specificity	Positive predictive value	Random predictive value
	TP/(TP+FN) x 100	TN/(TN+FP) x 100	TP/(TP+FP) x 100	
Domestic sewage	83	95	85	26
Animal	95	83	95	74

**RCC, rate of correct classification (also known as sensitivity). TP, test positive, isolate correctly identified to its source class; FN, false negative, isolate not identified to its true source class; TN, test negative, isolate correctly identified as not from the particular source; FP, false positive, isolate incorrectly identified as from a given source. Isolates that were unidentified after cross-validation analyses (<70% minimum similarity) were not used in these calculations.*

7.5 DISCRIMINANT ANALYSIS OF KB-ARA DATA

Data were first analyzed following the designated groups on the data sheets received from EP AREC. Isolates were labeled with the following classifications: avian, wildlife, pet, avian wild, livestock, and human. These were modified following discussion with the other project participants to form a seven-way classification (as presented throughout this report) of domestic sewage ("human"), wildlife avian, wildlife non-avian, pets, cattle, other livestock avian, and other livestock non-avian. The RCCs for the KB-ARA data analyzed with discriminant analysis and the seven-way split of source classifications are included in Table 7-1.

The KB-ARA discriminant analysis RCCs for the two-way split of source classes into domestic sewage and animal were 60 percent and 82 percent, respectively (data not shown). Discriminant analysis of four-way classification – domestic sewage (sewage and pet isolates), livestock (cattle, non-avian livestock), avian (avian wildlife and avian livestock) and wildlife (non-avian only) was also performed. These categories were more easily distinguished than the seven-way split classes and provided categories suitable for management purposes. RCCs ranged from 45 percent to 53 percent for each of these source classes.

The database was examined for appropriateness for antibiotic resistance analysis. Several concerns were identified. First, there was a lack of information regarding many of the sample collections and antibiotic usage. For example, some source samples were collected from state fair livestock animals (35 of 883 four-method composite library isolates), and may have been exposed/treated with antibiotics that would not represent the exposure of the majority of livestock animals impacting the watershed. Second, there were many animal sources that were unlikely to make a significant contribution to fecal contamination of the water bodies, either due to their physical size, habits, or population numbers. Ideally, to include those animal sources, the number of isolates from those sources in the library would have had to have been increased for discriminant analysis. Unfortunately, removing those sources from would have resulted in an unacceptably small database. Compromises were made to optimize the library for discriminant analysis of the KB-ARA within the constraints of the project. A number of isolates were re-categorized, primarily in the avian wildlife group, based on subjective judgment, field information provided, and the desired discriminate analysis classifications. In general, these issues are not problematic for the ERIC-PCR, RiboPrinting and PFGE analyses.

SECTION 8
OBSERVED *E. COLI* LEVELS IN LAKE WACO, BELTON LAKE, AND THEIR MAJOR TRIBUTARIES

Overall, the levels of *E. coli* observed in the samples collected from Lake Waco were far below the contact recreation geometric mean water quality criterion of 126 *E. coli* per 100 ml (Table 8-1). The geometric mean concentrations ranged from 5 cfu/100 ml at the deep water site near the dam to 11 cfu/100 ml near the inlet of the Middle and South Bosque Rivers (Figure 8-1). No samples from Lake Waco exceeded the single sample criterion of 394 cfu/100 ml for *E. coli*. The highest observed concentrations were in the Middle and South Bosque River arm.

In the North Bosque River, *E. coli* concentrations were more dynamic, as expected, since the volume of water for dilution of loads is less than that in the lake. *E. coli* were absent from more than half the samples at the site just upstream of Lake Waco, but one sample collected under runoff influences had a concentration of 8,500 cfu/100 ml. The geometric mean *E. coli* concentration of the samples at this site was 6 cfu/100 ml, and 14 percent of samples exceeded the single sample criterion, which indicates support for contact recreation use. Further upstream on the North Bosque River at Clifton (Station 11956), *E. coli* levels were similar, with a geometric mean concentration of 9 cfu/100 ml and 12 percent of samples exceeding the single sample criterion.

In Belton Lake, *E. coli* levels were very low throughout the lake. *E. coli* were absent from 131 (52%) of the 250 samples collected. Geometric mean *E. coli* concentrations ranged from 1 cfu/100 ml near the dam to 4 cfu/100 ml in the Leon River arm which are far below the contact recreation geometric mean water quality criterion of 126 *E. coli* per 100 ml (Figure 8-2). No samples exceeded the single sample criterion.

The highest *E. coli* levels of any site sampled in this study were observed in the Leon River upstream of Belton Lake (Station 11925). Concentrations ranged from 0 to more than 20,000 cfu/100 ml. The geometric mean *E. coli* concentration was 41 cfu/100 ml, well below the geometric mean criterion of 126, which indicates support of contact recreation use, but the single sample criterion was exceeded in 14 (28%) of the samples, which indicates nonsupport of contact recreation use. The levels were particularly high after runoff events, but on one date (April 20, 2004) *E. coli* levels exceeded the single sample criterion in dry weather, which may indicate the influence of contamination from a point source. A table summarizing the sampling results for each station is provided in Appendix A.

Table 8-1 Observed *E. coli* Levels from Water Quality Samples Collected

Station ID	Site	Sample count	Samples with *E. coli*	Concentration Range (#100 ml)	Geometric Mean Concentration	Samples >WQ Criterion (%)
11942	Lake Waco near Dam	100	74 (74%)	<1 – 78	5	0
11945	Lake Waco N. Bosque Arm	50	43 (86%)	<1 – 170	6	0
11948	Lake Waco Mid/ South Bosque Arm above SH 6	50	43 (86%)	<1 – 327	8	0
TBD3	Lake Waco Mid/ South Bosque Arm near inlet	50	45 (90%)	<1 – 360	11	0
11953	N. Bosque River near Valley Mills	50	22 (44%)	<1 – 8,500	6	7 (14%)
11956	N. Bosque River NE of Clifton	50	35 (70%)	<1 - 860	9	6 (12%)
11921	Belton Lake near dam	100	33 (33%)	<1 – 7	1	0
11922	Belton Lake Cowhouse Creek Arm	50	21 (42%)	<1 – 67	2	0
11923	Belton Lake Leon River Arm	50	32 (64%)	<1 – 361	4	0
TBD4	Belton Lake Owl Creek Arm	50	33 (66%)	<1 – 50	3	0
11925	Leon River at FM 1829 SE of North Fort Hood	50	39 (78%)	<1 - >20,000	41	14 (28%)

Figure 8-1 Geometric Mean of *E. coli* Concentrations - Lake Waco Sampling Sites, September 2003 through June 2004

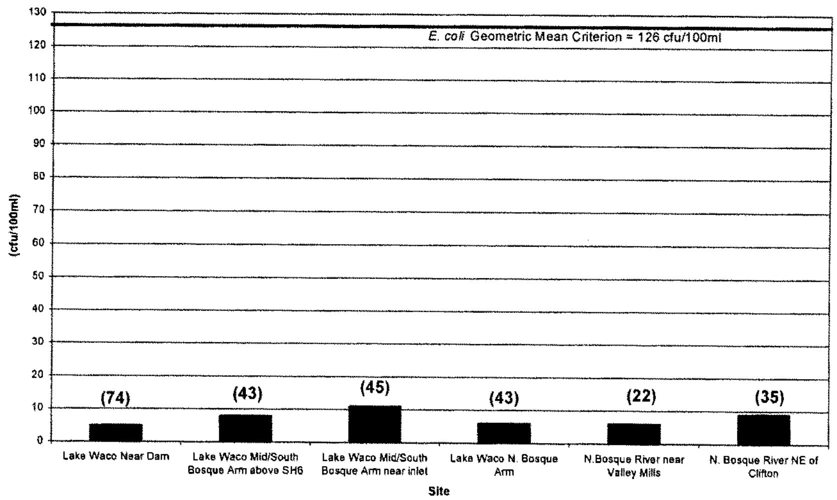
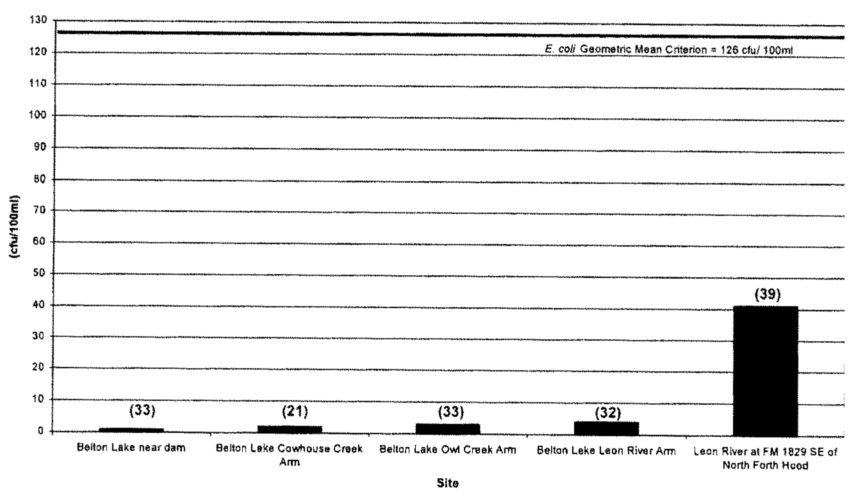


Figure 8-2 Geometric Mean of *E. coli* Concentrations - Belton Lake Sampling Sites, September 2003 through June 2004



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SECTION 9
BST RESULTS

9.1 SOURCE IDENTIFICATION OF WATER ISOLATES

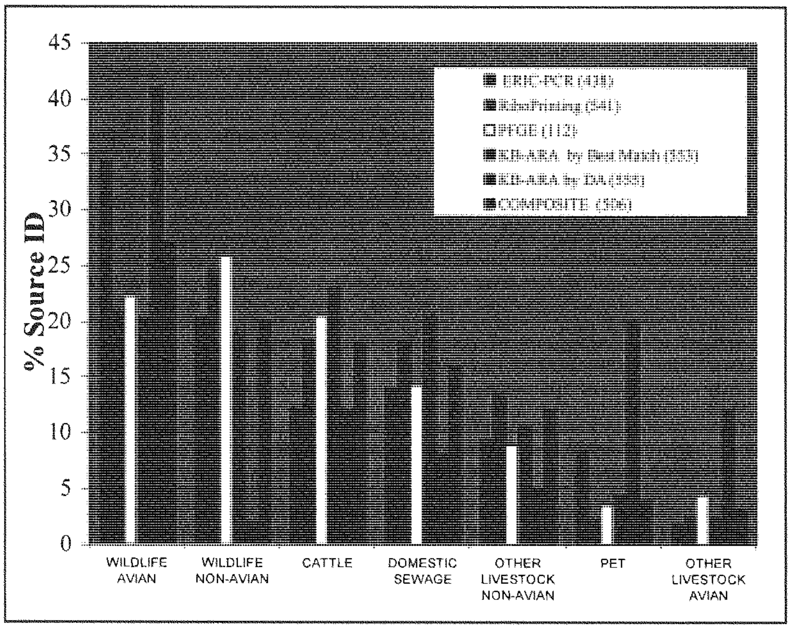
To assess the ability of each BST method and the four-method composite to identify unknown water isolates, a comparison was made between the percent identification to source class for water isolates from both Lakes Waco and Belton Lake watersheds (Figure 9-1). ERIC-PCR, RiboPrinting, PFGE, and KB-ARA (by best match) all identified wildlife, cattle and domestic sewage as the leading sources of contamination. As expected, the four-method composite identified the same major sources of contamination, since it reflects an average of the similarity matrices of the individual methods. The KB-ARA data analyzed using discriminant analysis results also agreed that wildlife is the leading source of contamination. However, identification of other sources of contamination based on discriminant analysis of the KB-ARA data differed from the three molecular methods, as well as the best match analysis of the KB-ARA data. Since best match analysis of KB-ARA data had higher or similar RCCs than discriminant analysis of the data for the potential major sources of pollution (*i.e.*, wildlife, cattle, and domestic sewage), best match analyses of these data were deemed acceptable. KB-ARA data were included in the four-method composite data set and were analyzed using best match.

It should be noted that PFGE patterns could not be generated for approximately 10 percent of the known library isolates and water isolates, limiting the number of library isolates to 883, and the number of water isolates for possible identification to 555. The water isolates that did not generate PFGE fingerprints were analyzed with a three-method composite data analysis, and had a similar distribution of source class identifications of water isolates as the four-method composite.

The four-method composite performed better than any single method for the QC study, had some of the highest RCCs in the seven-way split of source classes, and appeared representative of the identification of water isolates as compared to the individual methods. Given these findings, the identification of water isolates was based on the four-method composite data set.

Percent source identifications in Figure 9-1 are based on the number of isolates identified to each source class out of the number of total identification attempts (shown in parentheses for each method). Isolates that were unidentified because they did not match a library isolate at the minimum similarity are not shown.

Figure 9-1 Identification of Water Isolates from the Lakes Waco and Belton Watersheds using the Individual Methods and Four-Method Composite (555 water isolates vs. 883 known source isolates)



9.2 INTERPRETATION OF COMPOSITE BST RESULTS AND DISCUSSION

To facilitate the interpretation of results, it is helpful to have some understanding of the uncertainties involved in the source estimates. As the number of isolates identified increases, so does the confidence in the estimate of the source contribution. At individual sampling sites, the sources of only a few dozen *E. coli* isolates were identified, so there is a low confidence in the precision of source estimates for individual sites. This is especially true at some sites where *E. coli* were seldom observed. Table 9-1 illustrates the 95 percent confidence intervals for several different contributing source strengths and number of isolates typed. Ninety-five percent confidence implies that 95 times out of 100, the true result is expected to fall within the range indicated. Note that the 95 percent confidence interval estimates are very broad for source identifications based on 100 or fewer *E. coli*. Thus, results for individual monitoring locations must be viewed as rough approximations only. All figures in this section display the number of isolates on which the source contribution estimates are based, in order to facilitate estimation of the uncertainties involved.

Table 9-1 Example 95% Confidence Intervals for Various Contributing Source Magnitudes and Number of *E. coli* Isolates

Number of Isolates Identified	Source Contribution	Source Contribution 95% Confidence Interval
25	3%	0-10%
25	10%	0-22%
25	30%	12-48%
50	3%	0-8%
50	10%	2-18%
50	30%	17-43%
100	3%	0-6%
100	10%	4-16%
100	30%	21-39%
200	3%	1-5%
200	10%	6-14%
200	30%	24-36%
400	3%	1-5%
400	10%	7-13%
400	30%	26-34%

Summaries of sources identified based on the four-method composite at each individual sampling site and for each watershed are provided in Table 9-2. There was a wide variety of contributing sources at each site, and no single source category dominated. Considering all sites and dates combined (Figure 9-2), wild birds were identified as the contributors of 25 percent of the *E. coli* to water, followed by non-avian wildlife at 18 percent of the *E. coli*. Thus, wildlife contributed 43 percent of the *E. coli* from all sites combined. Livestock contributed 31 percent of the *E. coli*, with cattle contributing 17 percent, other livestock - avian at 3 percent, and other non-avian livestock at 11 percent. Sewage was identified as the source of an estimated 14 percent of the *E. coli*. Pets (dogs and cats) were estimated to contribute approximately 3 percent of the *E. coli*. The source of 9 percent of the *E. coli* could not be identified with acceptable confidence.

In a comparison of the source contributions identified in the single sampling event for which a strong runoff influence was questionable (November) versus those from all other sampling events, the source contributions were similar (Figure 9-3). *E. coli* from cattle were less abundant and pets more abundant, in a relative sense, in the runoff samples, but the differences were not statistically significant. It should be noted that identifying sources specifically under runoff conditions was not a goal of this project. Instead, the goal was to sample on a regular basis to capture various climatic conditions at their natural frequency in order to best represent the typical sources of *E. coli*.

The sources of 74 *E. coli* isolates did not generate a PFGE fingerprint and were identified with a three-method composite analysis are provided in Table 9-3. The sources identified are similar to those of the four-method composite analysis provided in Table 9-2.

Table 9-2 Sources of *E. coli* Isolates Based on Four-Method Composite Identification

Site	Station ID	Sewage/ Human	Livestock – cattle	Other Livestock - avian	Other Livestock - nonavian	Pets	Wildlife-avian	Wildlife-nonavian	Unidentified	Total *E. coli* Isolates
Lake Waco near dam	11942	27%	15%	3%	9%	4%	18%	18%	6%	67
Lake Waco N. Bosque River Arm	11945	14%	11%	5%	14%	0%	23%	14%	19%	57
Lake Waco Middle/South Bosque River Arm above SH 6	11948	16%	18%	4%	2%	0%	16%	18%	27%	45
Lake Waco Middle/South Bosque Arm near inlet of Middle/South Bosque River	TBD3	22%	24%	2%	9%	6%	22%	11%	4%	54
North Bosque River at SH 56 near Valley Mills	11953	8%	13%	2%	8%	8%	38%	21%	4%	53
North Bosque River at FM 219 northeast of Clifton	11956	13%	17%	3%	14%	3%	24%	18%	10%	72
Belton Lake near dam	11921	7%	7%	11%	4%	7%	26%	26%	11%	27
Belton Lake Cowhouse Creek arm	11922	17%	21%	0%	8%	8%	13%	17%	17%	24
Belton Lake Leon River arm near headwater	11923	14%	25%	2%	7%	0%	32%	20%	0%	44
Belton Lake Owl Creek arm	TBD4	17%	24%	0%	17%	0%	17%	26%	0%	42
Leon River at FM 1829 southeast of North Fort Hood	11925	4%	11%	0%	20%	4%	36%	19%	6%	70
Belton Lake watershed total		11%	17%	2%	13%	3%	28%	21%	5%	207
Lake Waco watershed total		17%	16%	3%	10%	3%	23%	17%	11%	348
Grand Total		14%	17%	3%	11%	3%	25%	18%	9%	555

Note that the precision of source identification estimates increases with the increasing number of E. coli isolates, and those for individual sites have broad 95 percent confidence intervals.

Table 9-3 Sources of 74 *E. coli* Isolates Based on a Three-Method Composite Identification (No PFGE Data Available)*

Site	Sewage/ Human	Livestock – cattle	Other Livestock - avian	Other Livestock - nonavian	Pets	Wildlife-avian	Wildlife-nonavian	Unidentified	Total *E. coli* Isolates
Belton Lake watershed total	5%	14%	10%	10%	0%	33%	29%	0%	21
Lake Waco watershed total	9%	4%	4%	11%	4%	36%	32%	0%	53

**Results based on composite data set using ERIC-PCR, RiboPrinting, and KB-ARA*

Figure 9-2 Source Contribution Estimates using Four-Method Composite Data for all Sites and Dates Combined (555 *E. coli* Isolates)

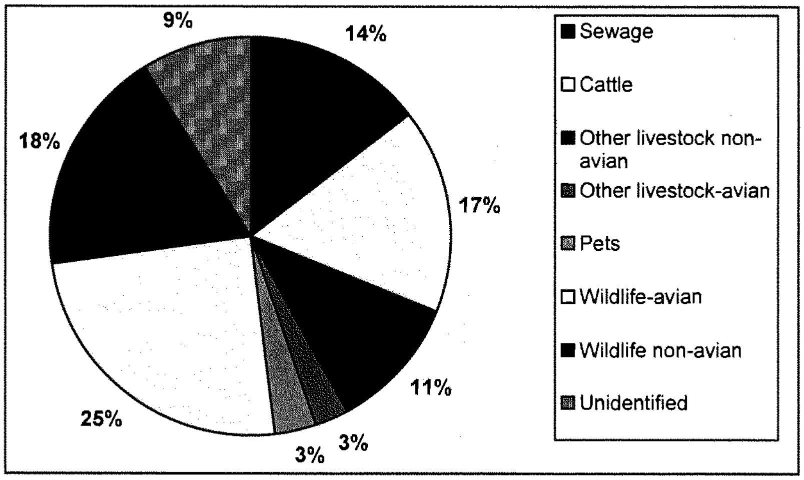
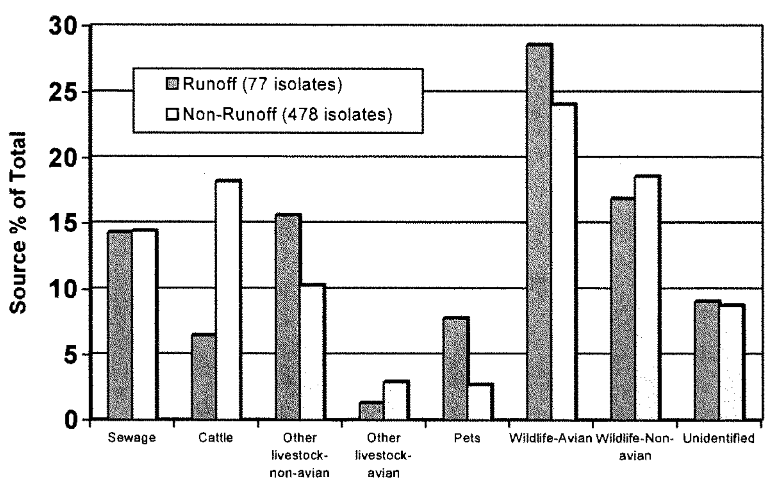


Figure 9-3 Comparison of Source Contribution Estimates for Runoff Samples (November) from all Sites vs. all Other Dates Combined Using Four-Method Composite Data



9.2.1 Aggregate Results Comparison between Lake Waco and Belton Lake

The sources of *E. coli* in Lake Waco and Belton Lake were similar (Figures 9-4 and 9-5). Figure 9-6 displays the same data in a different format by providing a side-by-side comparison of source contribution by category. Sewage contributed a larger percentage of *E. coli* in the Lake Waco watershed, and wildlife represented a larger contribution in the Belton Lake watershed, but the differences are not statistically significant at the 95 percent confidence level.

Figures 9-7 and 9-8 show the identified source contributions by month for Lake Waco and Belton Lake, respectively. The source contributions did not vary significantly with time in a systematic and statistically significant way.

Figure 9-4 Source Contribution Estimates using Four-Method Composite Data for all Lake Waco and North Bosque River Sites and all Dates Combined (348 *E. coli* Isolates)

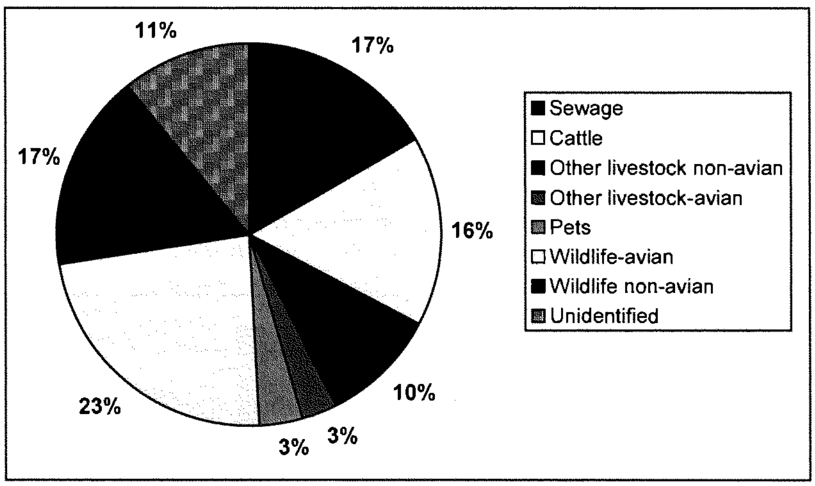


Figure 9-5 Source Contribution Estimates using Four-Method Composite Data for all Belton Lake and Leon River Sites and all Dates Combined (207 *E. coli* Isolates)

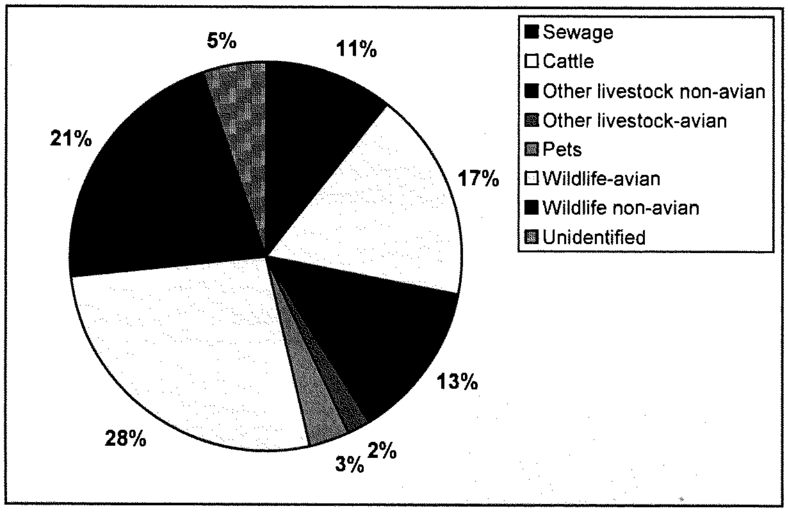


Figure 9-6 Comparison of Source Contribution Estimates for Belton Lake vs. Lake Waco using Four-Method Composite Data

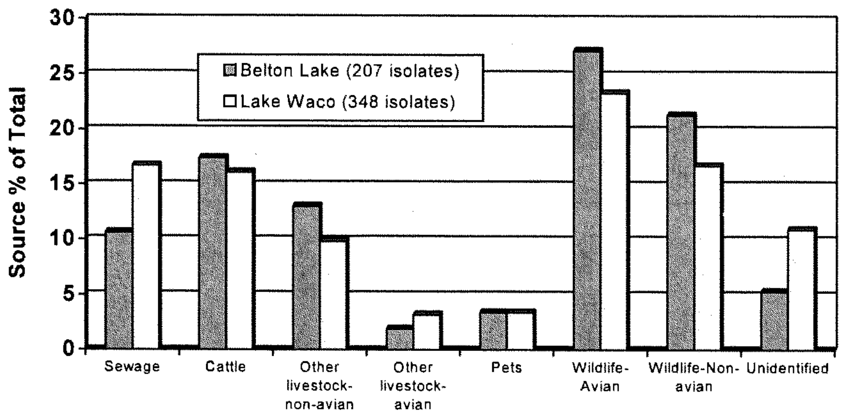


Figure 9-7 Comparison of Source Contribution Estimates by Month using Four-Method Composite Data for all Lake Waco / North Bosque River Sites Combined (348 *E. coli* Isolates)

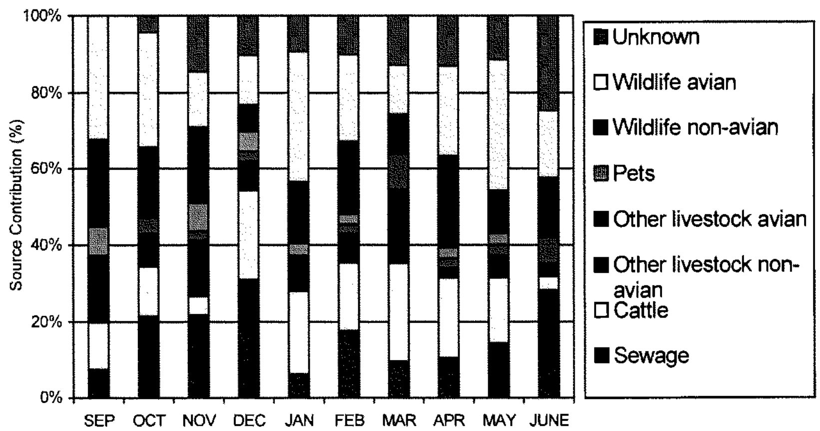
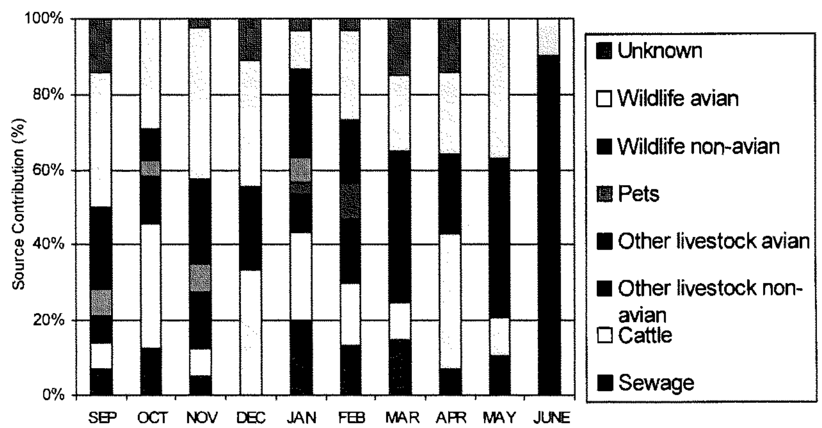


Figure 9-8 Comparison of Source Contribution Estimates by Month using Four-Method Composite Data for all Belton Lake / Leon River Sites Combined (207 *E. coli* Isolates)



9.2.2 BST Classification of Sources for Individual Monitoring Stations

Pie charts representing the source contributions for the 11 water quality monitoring stations associated with Belton Lake and Lake Waco are presented below in Figures 9-9 through 9-19. Although source contribution estimates for individual sites are too imprecise for statistically significant comparisons, the highest sewage contributions were seen in Lake Waco near the dam, a site near heavily populated areas of the City of Waco. The highest contributions from cattle were observed in the Leon River arm of Belton Lake and the Middle/South Bosque River arm of Lake Waco. The largest contributions from other livestock - avian were observed in Belton Lake near the dam, and the highest contributions from other non-avian livestock were observed in the Leon River near north Fort Hood. The highest avian wildlife contributions were observed in the north Bosque River near Valley Mills, perhaps due to a large swallow population observed to be nesting under the bridge. Non-avian wildlife contributions were most substantial in the Owl Creek arm of Belton Lake and near the Belton Lake dam. The highest pet contributions were observed in the North Bosque River near Valley Mills and in the Cowhouse Creek arm of Belton Lake. Wildlife (non-avian wildlife and avian wildlife combined) contributions represented the largest source percentage at all 11 stations and ranged from 30 to 59 percent. Only four of the 11 stations had more than 10 percent of the isolates that were not identifiable with Lake Waco Middle/South Bosque River arm at SH 6 having the highest percentage at 26.

Figure 9-9 Source Contribution Estimates using Four-Method Composite Data for Belton Lake near Dam (11921) - all Dates Combined (27 *E. coli* Isolates)

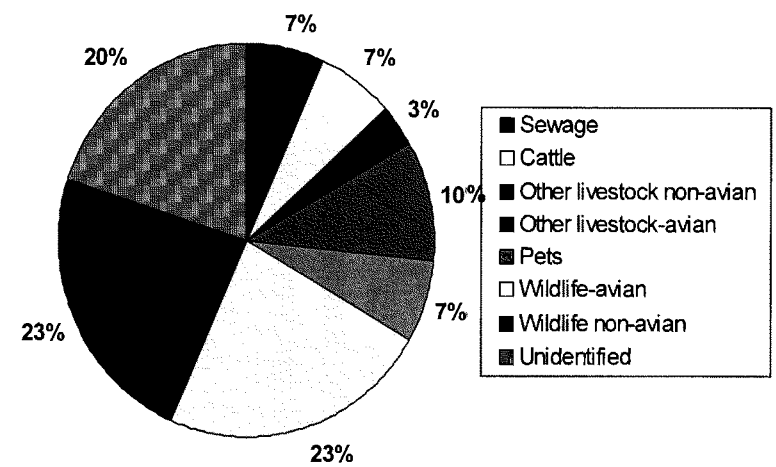


Figure 9-10 Source Contribution Estimates using Four-Method Composite Data for Belton Lake Cowhouse Creek Arm (11922) - all Dates Combined (24 *E. coli* Isolates)

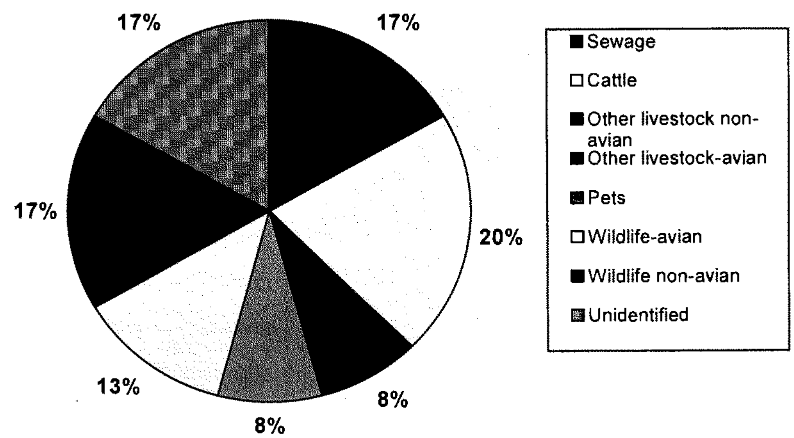


Figure 9-11 Source Contribution Estimates using Four-Method Composite Data for Belton Lake Owl Creek Arm (TBD4) - all Dates Combined (42 *E. coli* Isolates)

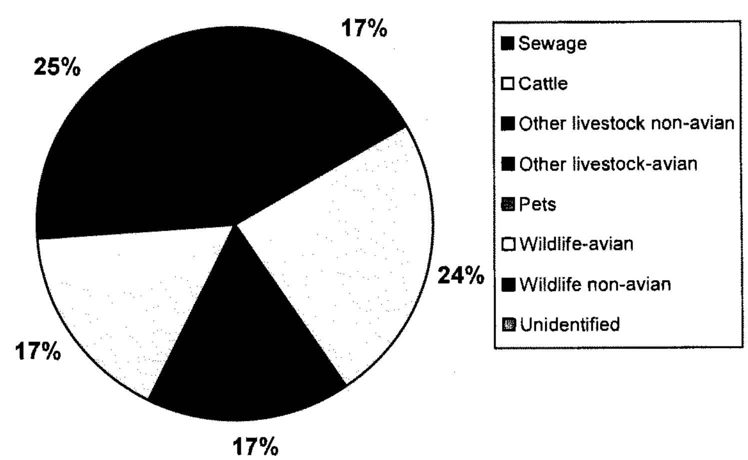


Figure 9-12 Source Contribution Estimates using Four-Method Composite Data for Belton Lake Leon River Arm near Headwater (11923) - all Dates Combined (44 *E. coli* Isolates)

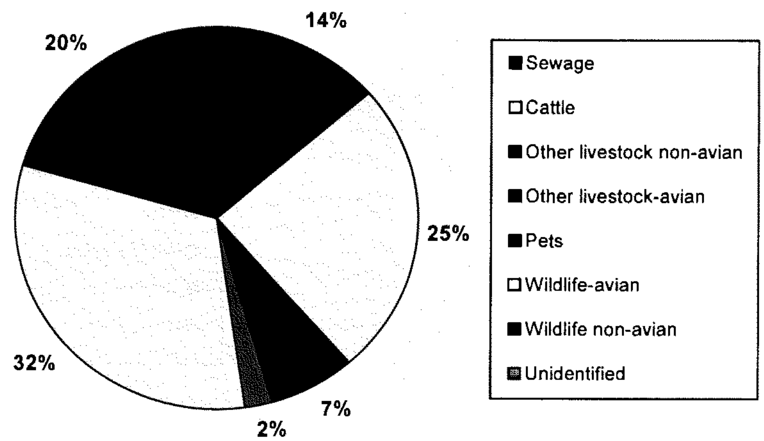


Figure 9-13 Source Contribution Estimates using Four-Method Composite Data for Leon River at FM 1829 southeast of North Fort Hood (11925) - all Dates Combined (70 *E. coli* Isolates)

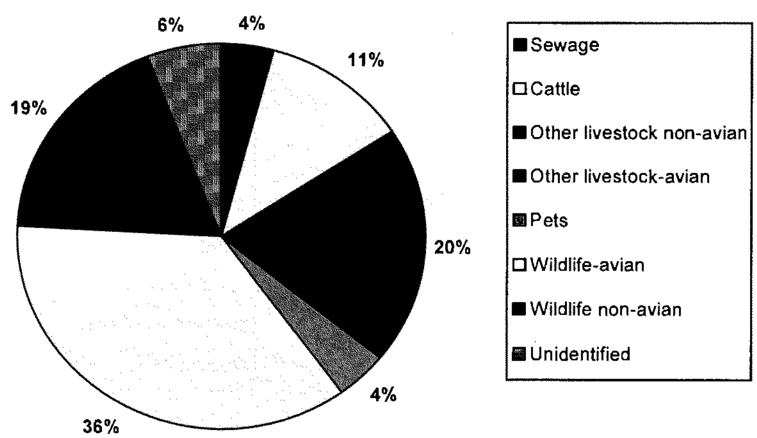


Figure 9-14 Source Contribution Estimates using Four-Method Composite Data for Lake Waco near Dam (11942) - all Dates Combined (67 *E. coli* Isolates)

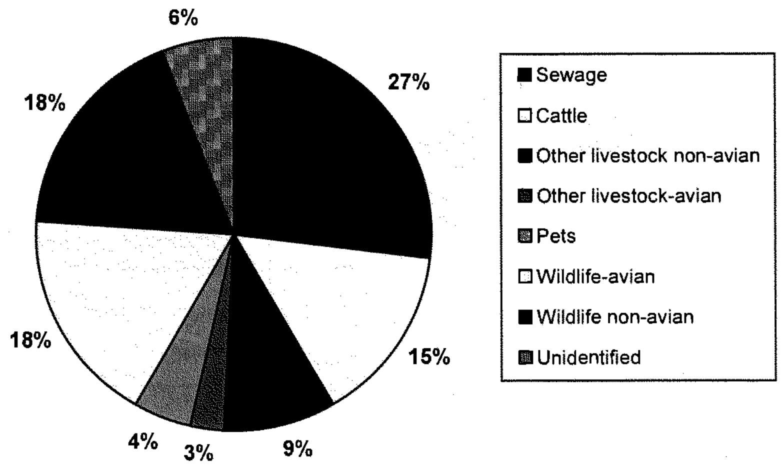


Figure 9-15 Source Contribution Estimates using Four-Method Composite Data for Lake Waco Middle/South Bosque River Arm above SH 6 (11948) - all Dates Combined (45 *E. coli* Isolates)

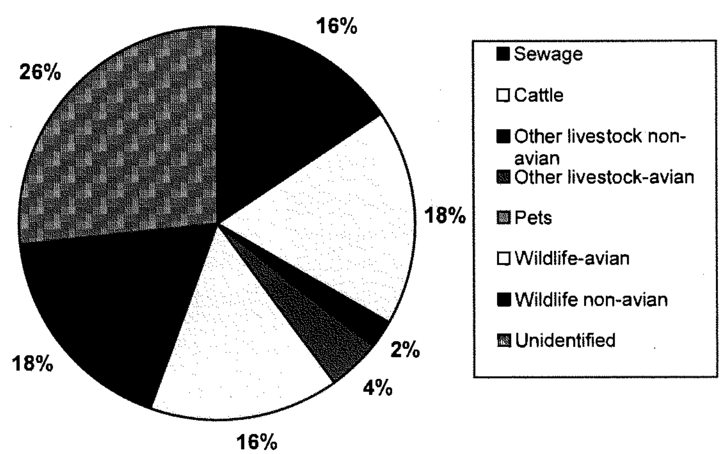


Figure 9-16 Source Contribution Estimates using Four-Method Composite Data for Lake Waco Middle/South Bosque River Arm near Inlet of Middle/South Bosque Rivers (TBD3) - all Dates Combined (54 *E. coli* Isolates)

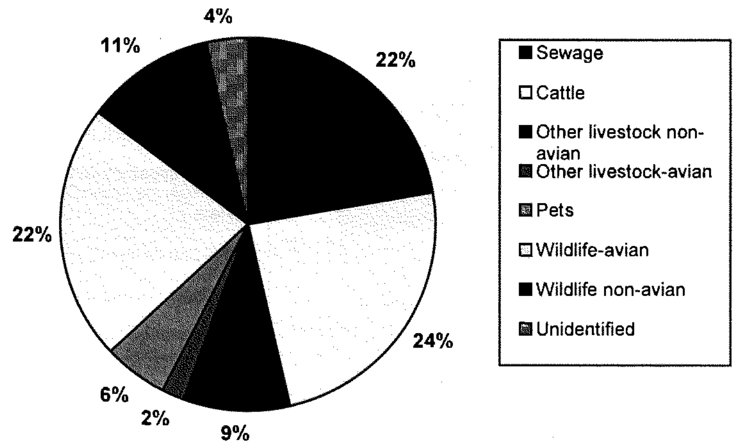


Figure 9-17 Source Contribution Estimates using Four-Method Composite Data for Lake Waco North Bosque River Arm (11945) - all Dates Combined (57 *E. coli* Isolates)

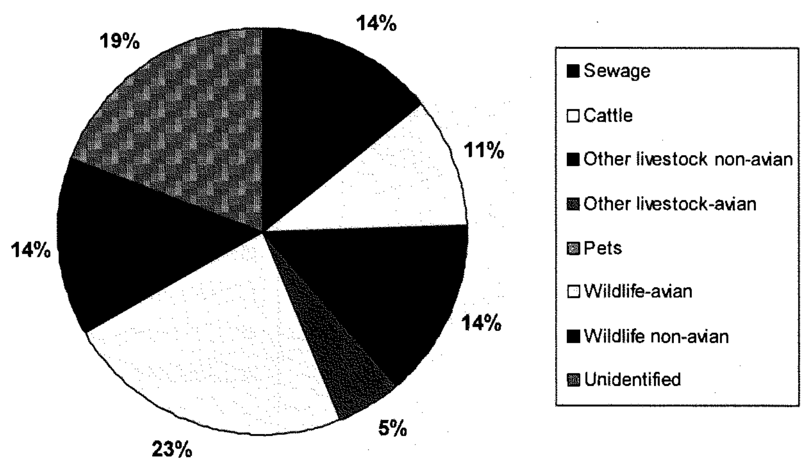


Figure 9-18 Source Contribution Estimates using Four-Method Composite Data for North Bosque River at SH 56 near Valley Mills (11953) - all Dates Combined (53 *E. coli* Isolates)

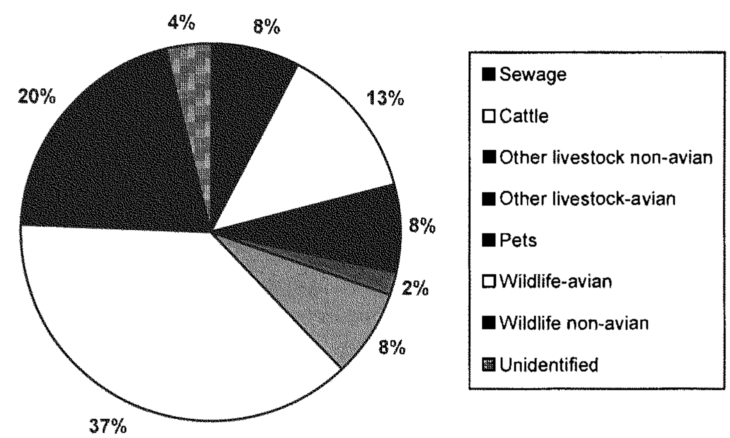
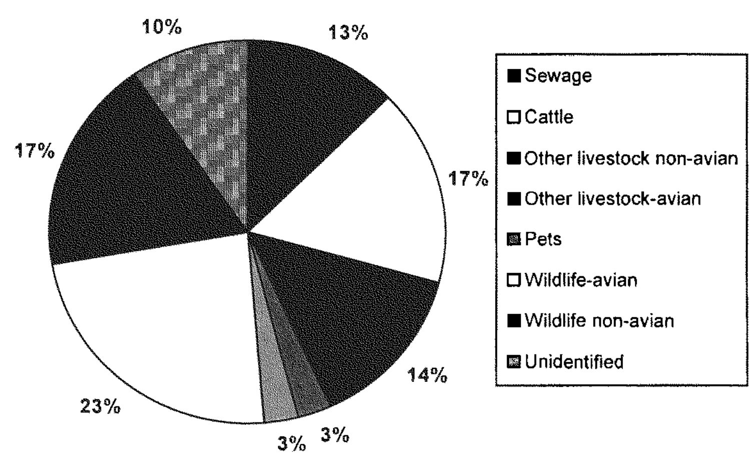


Figure 9-19 Source Contribution Estimates using Four-Method Composite Data for North Bosque River at FM 219 northeast of Clifton (11956) - all Dates Combined (72 *E. coli* Isolates)



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SECTION 10
STAKEHOLDER INVOLVEMENT

10.1 WORKSHOPS

Coordination among the project team members supporting this project was a high priority throughout the study period. The project team also recognized that communication with and feedback from stakeholders in each watershed would strengthen the project design and outcomes.

This project included two 3-hour stakeholder meetings or workshops, one at the beginning of the project in July 2003, and the second in October 2005. Both workshops were held at the TFB headquarters in Waco, Texas, and both were well attended with more than 40 people at each meeting. The lists of stakeholders invited to each workshop are provided in Appendix K. The objectives of the first stakeholder workshop were to:

- Introduce the project team and summarize the project work plan;
- Define what the project was and was not intended to do;
- Provide an introduction on how BST methods provide data necessary to identify specific sources of bacteria; and
- Obtain local knowledge about geographic origin of *E. coli* sources.

During the first workshop in July 2003, Parsons received a number of beneficial suggestions on potential bacteria sources in both watersheds which were taken into account when conducting the sanitary survey and developing the sampling design. The objectives of the second workshop were to:

- Summarize the Lake Waco/Belton Lake BST sampling design;
- Describe laboratory approaches used to analyze and classify *E. coli* bacteria; and
- Provide a summary of the data results that categorize the contributing sources of *E. coli* to Lake Waco and Belton Lake.

10.2 SUMMARY OF QUESTIONS AND RESPONSES FROM WORKSHOP 2

There were a number of questions posed by the stakeholder group at the second workshop in October 2005. Several of these questions are paraphrased below and a brief response follows each question.

1. Are the water quality sampling results transferable to TCEQ for inclusion in the TCEQ surface water quality monitoring database?

   Yes. The data results can be transferred to TCEQ since the data were collected using a TCEQ-approved QAPP. The data will be submitted for inclusion in the TCEQ water quality database.

2. How many of the 10 scheduled sampling events were runoff events?

   Three of the 10 events (November, January, and March) included water samples collected after rainfall or under increased flow conditions.

3. Was the project structured to identify instream bacteria from aquatic species?

   No. The nature of this project was to focus on identifying bacteria sources from warm-blooded species since they have the potential to cause human health concerns. Aquatic species in Texas streams are cold-blood and it is therefore assumed that bacteria from these species would not present public health concerns.

4. With the data collected can estimates be given for the percent contribution of different sources for subwatersheds of Lake Waco and Belton Lake?

   The data collected cannot provide sufficient resolution to quantify bacteria sources for different subwatersheds upstream of each lake. The sampling design was not set up to do this and the cost of providing that level of resolution was beyond the resources of this project.

5. Can bacteria from dairy cattle and beef cattle be differentiated using the data from this study?

   No. The E. coli fingerprints from beef and dairy cattle gut do not appear to be distinct from each other. However, it is possible to obtain more site-specific data to assist BST results in differentiating sources at the subwatershed level.

6. Were bacteria from feral hogs and domestic swine differentiated using the data from this study?

   There was little cross-identification between wildlife non-avian (the source category for feral hog and javelina) and other livestock non-avian (the source category for swine), suggesting that these sources can be differentiated. There were a total of 32 isolates analyzed from these sources with all four BST methods. An evaluation of the data for these isolates suggests that E. coli from feral hogs and javelina can be distinguished from E. coli from swine; however, the total number of isolates is relatively small, and it is unknown if this will continue to be the case as the library is expanded.

7. Why were there especially high levels of unidentified isolates in the one sampling station (Lake Waco Middle/South Bosque arm above SH 6)?

   The percentages can appear high but they may only represent a few (in this case 12) isolates. In other words, the higher the number of isolates used in an analysis, the lower the percentage of unidentified isolates. An allowance will be made for unidentified isolates in the analysis instead of trying to force a match to a fingerprint. It is possible that the source isolate was not available in the library, or the animal was represented, but this was a unique isolate not found in the library.

8. You used a composite of the four BST methods; has this been done before?

   To date, no study of this type has been published in a peer-reviewed journal, although other research groups are now looking into this type of approach. Comparing the four BST methods allows all the data gathered to be used and appears to balance out the extremes in method resolution.

9. Will the report discuss how the methods compare and what is best to use when you cannot afford (time, money, or expertise) to do all four methods as a composite?

   Yes. Comparison of the different method combinations is still being done, and will be included in the final report. Method comparisons and congruence measurements show that a combination of ERIC-PCR and RiboPrinting may work just as well as the four-method composite.

10. You mentioned there were many swallows under the bridge at one of the sampling sites, and that a majority of those isolates from that water segment were identified as wildlife avian. Do you try to take other water samples up or down stream in the vicinity when you see something like that?

    The general procedure is to try to take the samples 10-20 yards upstream of the bridge to minimize the effects of the bridge on water quality measurements, but 1) going farther upstream or downstream would have required trespassing on private land, and 2) the QAPP mandates where samples will be taken, and deviations from that plan cannot be made.

11. How different are the livestock categories?

    Library isolates were divided into different source categories based on management practices. The livestock was grouped into 1) cattle, 2) other livestock non-avian, and 3) other livestock avian. However, the resolution of the BST techniques may not be sufficient to distinguish the other livestock non-avian and avian categories as evidenced by the levels of cross-identification. Also, the number of other livestock avian library isolates was small and may not have been sufficient for source class evaluation of the library.

12. Will the differences in the number of wildlife and human isolates used in the library impact the identification of the unknowns (the influence of the number of isolates over the overall analysis of the samples)?

    More important than the number of isolates in the library from a given source is the representativeness of the isolates. It is not known how large an optimum library needs to be. The library was designed to be diverse by limiting the clones (identical isolates from the same sample) and choosing unique isolates from known source categories to represent the diversity of E. coli found in the feces of the different hosts. Humans and wildlife, in general, seem well-represented as seen by the library analysis. A larger library has a better chance of identifying unknown water isolates, but because the analysis done in this study allows for "unidentified" isolates (instead of force grouping) that should limit false identifications. Statistical methods to evaluate the library are still being explored, and those results will be included in the final report.

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SECTION 11
RECOMMENDATIONS FOR FUTURE BST STUDIES

11.1 BST PROJECT DESIGN

Well defined DQOs are an important first step with any water quality assessment project including BST projects. This section identifies key issues and recommendations that should be acknowledged when considering undertaking a BST project. However some of the key issues which affect DQOs and the sampling design of BST projects that must be given special attention are:

- budget,
- discriminatory capability desired of BST methods,
- size and diversity of known source library, and
- long-term maintenance of library isolates.

Library size and the representativeness of *E coli* strains in a known source library are two major considerations that need to be carefully assessed before embarking on any BST study (USEPA 2005). While there are an array of factors that influence the appropriate size of a known source library, (size of watershed, number and diversity of sources, migration of animal species, etc.) Texas' recent completion of BST projects in different parts of the state has provided a valuable start to a useful library.

Regarding the costs of BST projects, there are too many variables with each project to provide typical ranges one could use in setting a budget for the use of BST. Library dependent methods such as RiboPrinting and ERIC-PCR do require significant funding but the discriminatory capability of these methods can now provide data of greater value to water resource managers. It should be recognized that the investment in infrastructure by the state and USEPA needed to make this project possible has value to future BST projects in the state. EP AREC and TAMU now have the equipment necessary to perform additional studies and the *E. coli* culture collection obtained through this project is being maintained by EP AREC. The availability of this library will make it possible to reduce the number of source samples that need to be collected in future studies. Further, the use of recently developed library-independent methods as part of the BST "toolbox" may also reduce the sampling requirements. Together, these may allow future BST studies to be conducted at significantly less expense. Parsons, Texas Agricultural Experiment Station and TAMU are committed to assisting the state with future BST projects as funding and resources are made available.

The level of discriminatory capability desired will also drive DQOs. BST projects are typically designed to differentiate:

5) human vs. all other sources,
6) species specific results (human vs. cows vs. horses vs. deer, *etc.*),
7) group comparisons (human vs. livestock vs. wildlife), and

8) specific individual hosts (cows from a certain farm vs. other farms vs. other livestock on farms vs. human etc. (USEPA 2005).

Setting up well defined DQOs guided by one of the four options listed above is a critical step in any project design and has a direct bearing on project costs. An assessment method employed by this study that provided significant utility was the sanitary survey. The sanitary survey provided valuable watershed-specific data that improved the sampling design. All BST projects should adequately invest in conducting a thorough sanitary survey. The sanitary survey can also be useful in determining which level of discriminatory capability is most appropriate to use in a project.

Finally, when considering the use of library dependent methods, special attention should be given to the long-term maintenance of the library isolates for future use and application. Building a regionally representative and diverse library of known source isolates for the state of Texas should be given consideration. Special attention should also be given to ensuring that future BST projects in Texas adhere to a QAPP that will allow the samples (isolates) collected to be used in conjunction with the known source library developed for this project.

11.2 CORRESPONDENCE BETWEEN METHODS

Using the 883 known source isolate library, the congruence between individual BST techniques, all two and three-method combinations, and the four-method composite data set were determined using BioNumerics (Figure 11-1). The dendrogram in Figure 11-1 reveals the relationship between the different techniques and composite data sets, and the percent similarity of each method or combination to the four-method composite is included. As expected, the methods do not agree 100 percent with each other due to the differences in resolution between the methods and the fact that they each measure different attributes of *E. coli*.

It may not be feasible in terms of both cost and time considerations to perform all four BST methods used here for future BST studies. The congruence measurement revealed that the two individual techniques most similar to the four-method composite data set were ERIC-PCR and RiboPrinting, with 77.9 percent and 60.8 percent similarity, respectively. This was also not surprising, since PFGE and KB-ARA are at the extremes of the spectrum for their ability to resolve differences between bacterial isolates. The ERIC-PCR RiboPrinting composite data set was found to be the closest two-method combination (90.7 percent similar) to the four-method composite data set. These results suggest that a combination of just ERIC-PCR and RiboPrinting may be suitable for future library-based BST studies. In addition, additional analysis of the QC study data demonstrated that a composite ERIC-RP data set correctly identified 100% of the replicate QC cultures, and had 90% accuracy for the *E. coli* strain and source class identification of the isolates.

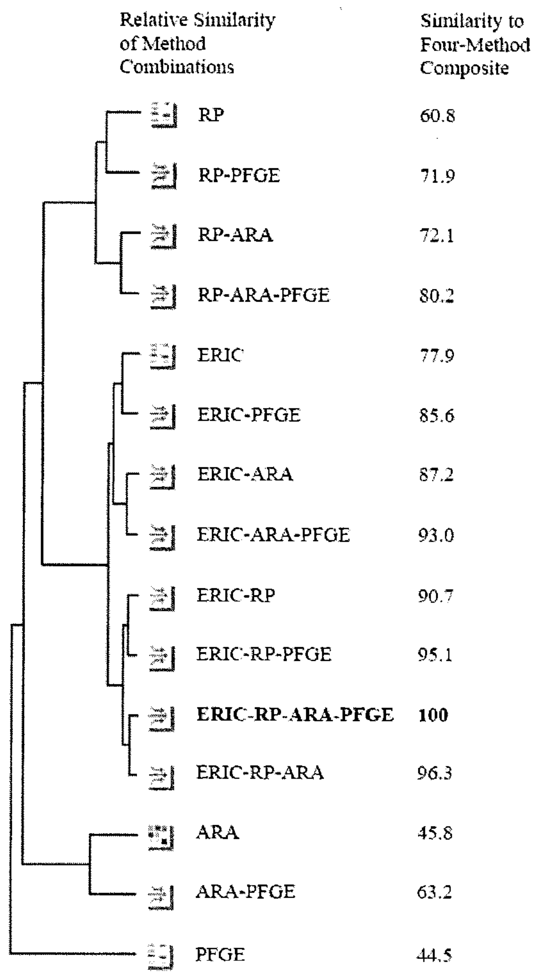
It should also be noted that since the beginning of this study, there have been significant developments in library-independent source tracking methods. While some of these developments appear promising, it is still too early to tell if they will be capable of replacing library-dependent BST methods. One particular weakness of these recently developed approaches is the difficulty of interpreting results in relation to regulatory water quality standards and microbial risk, since they often target microorganisms that are not regulated and that have not been included in prior microbial risk assessments. Nonetheless, for future studies in Texas, it is recommended that these methods be given consideration, not as stand-alone methods, but rather as part of a "toolbox" approach to BST, along with the library-dependent methods.

The use of four different BST methods in this study provided valuable insights to BST methods. This is believed to be one of the first studies to directly compare BST methods by using the same collection of *E. coli* isolates. The methods used covered the spectrum in cost, ease of use, and discriminatory ability. As hypothesized, data from the combined methods (composite data set) were more useful than any individual method. Further, congruence measurements suggest that an ERIC-PCR and RiboPrinting composite data may be as useful as the four methods combined. In future studies, ERIC-PCR and RiboPrinting appear to be the methods of choice since they provide the highest rate of correct classification, and the other methods used to further characterize specific groups of isolates as needed. This would provide for cost, labor, and time savings while not compromising integrity of the BST results.

Key Recommendations

- Special attention should also be given to ensuring that future BST projects in Texas adhere to a TCEQ- or TSSWCB-approved QAPP.
- BST projects should adequately invest in conducting a thorough sanitary survey.
- When considering the use of library dependent methods, special attention should be given to the long-term maintenance of the library isolates for future use and application.
- The combination of ERIC-PCR and RiboPrinting appear to be the most suitable as well as accurate methods for future library-based BST studies.

Figure 11-1 Congruence of Individual BST Methods and Composite Data Sets*



* Labels in Figure 11-1 are as follows: ERIC= ERIC-PCR; RP=RiboPrinting; ARA= KB-ARA; PFGE=PFGE, ERIC-RP-ARA-PFGE = 4-method composite data set; other composites are hyphenated.

SECTION 12
CONCLUSIONS FROM BST RESULTS

The TFB recognized that alternative water quality assessment methods would be required to achieve the objectives of this project. In most Texas watersheds, existing data are insufficient to provide water resource managers with detailed information about which sources of bacteria to target to achieve beneficial load reductions. Reaching beyond the standard suite of techniques used to assess bacteria, the TFB, Parsons, and TAMU worked together to promote and utilize BST methods. As a result, this study provides a wealth of information to state and local agencies in Texas from which future BST studies can be designed. The data now available from a BST study such as this validate the wide array of bacteria sources contributing loading to surface water. While the costs and time requirements associated with the different BST analytical methods used vary, the quality-assured data derived from this study provide water resource managers with the confidence needed to gain support from stakeholders to address specific sources of bacteria. It should be recognized that data from BST studies such as this have limitations to the spatial and temporal questions that can be answered. This study has accomplished the project objectives and adhered to the data quality objectives set forth in the QAPP. The key conclusions derived from this BST project are:

- BST results indicate that wildlife (avian and non-avian) is the major contributor to fecal pollution for both Lake Waco and Belton Lake. Wildlife was identified as the source of 40 percent and 49 percent of the *E. coli* isolated from Lake Waco and Belton Lake water samples, respectively.

- It had been previously speculated that livestock, in particular cattle, and other agricultural activities were responsible for the majority of fecal pollution in these watersheds. Contributions to fecal pollution by cattle as determined by BST are similar for both Lake Waco and Belton Lake watersheds, with 16 percent and 17 percent of the *E. coli* isolates from water identified as cattle source, respectively. Looking at the contributions from cattle at each of the 11 monitoring stations at both lakes, the percentage is less than or equal to 25 percent. Thus, these results demonstrate that cattle are not the major contributing source of bacteria to Lake Waco and Belton Lake. If the cattle, other livestock - avian, and non-avian livestock source classes are combined into a "livestock" class, livestock appear to be the second leading source of fecal pollution, with 29 percent and 32 percent of the water isolates from Lake Waco and Belton Lake, respectively, identified to this source.

- Unexpectedly, domestic sewage is identified as the third leading contributor to fecal pollution in the watersheds, with 17 percent of the Lake Waco and 11 percent of the Belton Lake *E. coli* isolates identified to this source. Of particular concern is the finding that the sampling site with the highest occurrence (27%) of *E. coli* isolates identified as sewage is at Lake Waco near the dam (Station 11942), which is also near the drinking water treatment plant intake. While microorganisms capable of causing disease in humans can be found in animal feces, domestic sewage typically contains much higher levels of these organisms. Therefore, from a human health perspective, this site may be at greatest risk.

- Levels of *E. coli* were low in both Lake Waco and Belton Lake, and *E. coli* were absent from approximately one third of the samples collected.
- Additional data collection would be necessary to present more definitive conclusions of how stormwater runoff might influence percent contributions from source categories.
- The BST results provide valuable information that will assist water resource managers in targeting future management strategies to address bacteria contributions from specific source categories in each watershed.

SECTION 13
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APPENDIX A
AMBIENT WATER QUALITY DATA

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Appendix A
Ambient Water Quality Data

Station ID	Station Description	Date	Number of Samples	Minimum EC Conc*	Maximum EC Conc*	Geometric Mean EC Conc.*	Number of Samples with EC present	Number of Samples with EC Conc. > 394*	Total Suspended Solids (mg/L)
11921	Lake Belton near dam	9/15/2003	10	<1	2	0.66	3	0	10
11922	Lake Belton Cowhouse Creek Arm	9/15/2003	5	<1	<1	<1	0	0	7
11923	Lake Belton Leon River Arm near headwater	9/15/2003	5	<1	<1	<1	0	0	34
11925	Leon River at FM 1829	9/16/2003	5	<1	12	1.00	2	0	42
TBD4	Lake Belton Owl Creek Arm	9/15/2003	5	<1	1	0.66	2	0	15
11942	Lake Waco near dam	9/16/2003	10	<1	3	0.64	2	0	23
11945	Lake Waco North Bosque arm	9/16/2003	5	<1	3	1.25	4	0	24
11948	Lake Waco Middle/South Bosque arm above SH6	9/16/2003	5	<1	<1	<1	0	0	9
11953	North Bosque River at SH 56 near Valley Mills	9/16/2003	5	<1	70	4.42	3	0	28
11956	North Bosque River at FM 219 northeast of Clifton	9/16/2003	5	<1	30	6.83	4	0	
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	9/16/2003	5	<1	6	1.25	4	0	9
11921	Lake Belton near dam	10/20/2003	10	<1	<1	<1	0	0	4
11922	Lake Belton Cowhouse Creek Arm	10/20/2003	5	<1	1	0.57	1	0	5
11923	Lake Belton Leon River Arm near headwater	10/20/2003	5	12	29	22.88	5	0	42
11925	Leon River at FM 1829	10/21/2003	5	1	82	21.04	5	0	22
TBD4	Lake Belton Owl Creek Arm	10/20/2003	5	<1	20	8.07	4	0	29
11942	Lake Waco near dam	10/21/2003	10	27	53	34.84	10	0	31
11945	Lake Waco North Bosque arm	10/21/2003	5	12	21	15.75	5	0	22
11948	Lake Waco Middle/South Bosque arm above SH6	10/21/2003	5	42	58	48.33	5	0	27
11953	North Bosque River at SH 56 near Valley Mills	10/21/2003	5	<1	2	0.60	1	0	5
11956	North Bosque River at FM 219 northeast of Clifton	10/21/2003	5	<1	15	0.91	1	0	3
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	10/21/2003	5	45	64	52.35	5	0	25
11921	Lake Belton near dam	11/19/2003	10	1	7	2.51	10	0	2
11922	Lake Belton Cowhouse Creek Arm	11/19/2003	5	2	12	4.36	5	0	5
11923	Lake Belton Leon River Arm near headwater	11/19/2003	5	2	8	4.58	5	0	19
11925	Leon River at FM 1829	11/18/2003	5	710	1,060	852.06	5	5	77
TBD4	Lake Belton Owl Creek Arm	11/19/2003	5	2	12	6.45	5	0	20
11942	Lake Waco near dam	11/19/2003	10	12	25	19.67	10	0	18
11945	Lake Waco North Bosque arm	11/19/2003	5	15	24	18.91	5	0	8
11948	Lake Waco Middle/South Bosque arm above SH6	11/19/2003	5	18	31	21.37	5	0	18
11953	North Bosque River at SH 56 near Valley Mills	11/18/2003	5	<1	550	85.75	4	2	12
11956	North Bosque River at FM 219 northeast of Clifton	11/18/2003	5	320	860	609.43	5	4	12
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	11/19/2003	5	9	18	13.07	5	0	13
11921	Lake Belton near dam	12/17/2003	10	<1	<1	<1	0	0	2
11922	Lake Belton Cowhouse Creek Arm	12/17/2003	5	<1	1	0.57	1	0	6
11923	Lake Belton Leon River Arm near headwater	12/17/2003	5	<1	2	0.76	2	0	27
11925	Leon River at FM 1829	12/16/2003	5	20	48	30.51	5	0	4
TBD4	Lake Belton Owl Creek Arm	12/17/2003	5	<1	<1	<1	0	0	8
11942	Lake Waco near dam	12/17/2003	10	18	31	24.93	10	0	6
11945	Lake Waco North Bosque arm	12/17/2003	5	2	11	4.99	5	0	8
11948	Lake Waco Middle/South Bosque arm above SH6	12/17/2003	5	10	19	14.54	5	0	10
11953	North Bosque River at SH 56 near Valley Mills	12/16/2003	5	<1	13	0.89	1	0	2
11956	North Bosque River at FM 219 northeast of Clifton	12/16/2003	5	1	13	3.00	5	0	5
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	12/17/2003	5	25	32	27.29	5	0	7
11921	Lake Belton near dam	1/20/2004	10	1	5	2.97	10	0	5
11922	Lake Belton Cowhouse Creek Arm	1/20/2004	5	12	20	15.54	5	0	6
11923	Lake Belton Leon River Arm near headwater	1/20/2004	5	282	361	329.10	5	0	22
11925	Leon River at FM 1829	1/20/2004	5	126	680	317.55	5	1	35

Appendix A
Ambient Water Quality Data

Station ID	Station Description	Date	Number of Samples	Minimum EC Conc*	Maximum EC Conc*	Geometric Mean EC Conc.*	Number of Samples with EC present	Number of Samples with EC Conc. > 394*	Total Suspended Solids (mg/L)
TBD4	Lake Belton Owl Creek Arm	1/20/2004	5	31	50	39.19	5	0	10
11942	Lake Waco near dam	1/21/2004	10	<1	78	14.76	8	0	7
11945	Lake Waco North Bosque arm	1/21/2004	5	<1	170	29.13	4	0	17
11948	Lake Waco Middle/South Bosque arm above SH6	1/21/2004	5	1	327	87.15	5	0	17
11953	North Bosque River at SH 56 near Valley Mills	1/20/2004	5	<1	420	5.32	2	1	6
11956	North Bosque River at FM 219 northeast of Clifton	1/20/2004	5	<1	640	25.18	4	1	5
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	1/21/2004	5	278	360	313.41	5	0	21
11921	Lake Belton near dam	2/17/2004	10	<1	2	1.23	8	0	3
11922	Lake Belton Cowhouse Creek Arm	2/17/2004	5	<1	2	0.76	2	0	6
11923	Lake Belton Leon River Arm near headwater	2/17/2004	5	14	25	17.40	5	0	18
11925	Leon River at FM 1829	2/17/2004	5	<1	12	1.00	2	0	10
TBD4	Lake Belton Owl Creek Arm	2/17/2004	5	5	14	7.87	5	0	21
11942	Lake Waco near dam	2/16/2004	10	<1	17	3.03	7	0	5
11945	Lake Waco North Bosque arm	2/16/2004	5	<1	4	2.05	4	0	2
11948	Lake Waco Middle/South Bosque arm above SH6	2/16/2004	5	<1	17	7.07	4	0	5
11953	North Bosque River at SH 56 near Valley Mills	2/17/2004	5	<1	6	0.77	1	0	2
11956	North Bosque River at FM 219 northeast of Clifton	2/17/2004	5	<1	5	1.66	4	0	3
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	2/16/2004	5	<1	22	1.07	1	0	10
11921	Lake Belton near dam	3/15/2004	10	<1	<1	<1	0	0	9
11922	Lake Belton Cowhouse Creek Arm	3/15/2004	5	55	67	61.85	5	0	13
11923	Lake Belton Leon River Arm near headwater	3/15/2004	5	<1	18	2.05	3	0	19
11925	Leon River at FM 1829	3/16/2004	5	10,600	20,000	17,615	5	5	494
TBD4	Lake Belton Owl Creek Arm	3/15/2004	5	<1	6	1.35	3	0	19
11942	Lake Waco near dam	3/16/2004	10	3	20	9.51	10	0	7
11945	Lake Waco North Bosque arm	3/16/2004	5	14	30	18.03	5	0	12
11948	Lake Waco Middle/South Bosque arm above SH6	3/16/2004	5	7	24	15.54	5	0	14
11953	North Bosque River at SH 56 near Valley Mills	3/16/2004	5	<1	8,500	756.81	4	4	29
11956	North Bosque River at FM 219 northeast of Clifton	3/16/2004	5	225	800	294.37	5	1	1
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	3/16/2004	5	55	67	62.42	5	0	15
11921	Lake Belton near dam	4/19/2004	10	<1	1	0.57	2	0	1
11922	Lake Belton Cowhouse Creek Arm	4/19/2004	5	<1	1	0.57	1	0	18
11923	Lake Belton Leon River Arm near headwater	4/19/2004	5	<1	4	1.78	4	0	10
11925	Leon River at FM 1829	4/20/2004	5	331	470	407.86	5	3	25
TBD4	Lake Belton Owl Creek Arm	4/19/2004	5	1	4	1.64	5	0	18
11942	Lake Waco near dam	4/20/2004	10	<1	7	2.78	9	0	8
11945	Lake Waco North Bosque arm	4/20/2004	5	<1	3	1.08	3	0	7
11948	Lake Waco Middle/South Bosque arm above SH6	4/20/2004	5	1	4	1.32	5	0	8
11953	North Bosque River at SH 56 near Valley Mills	4/20/2004	5	66	169	115.60	5	0	11
11956	North Bosque River at FM 219 northeast of Clifton	4/20/2004	5	21	38	25.77	5	0	2
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	4/20/2004	5	1	4	2.00	5	0	12
11921	Lake Belton near dam	5/17/2004	10	<1	<1	<1	0	0	5
11922	Lake Belton Cowhouse Creek Arm	5/17/2004	5	<1	1	0.57	1	0	17
11923	Lake Belton Leon River Arm near headwater	5/17/2004	5	<1	3	1.08	3	0	9
11925	Leon River at FM 1829	5/18/2004	5	<1	46	3.20	3	0	25
TBD4	Lake Belton Owl Creek Arm	5/17/2004	5	<1	6	1.30	2	0	19
11942	Lake Waco near dam	5/18/2004	10	<1	2	0.81	4	0	7
11945	Lake Waco North Bosque arm	5/18/2004	5	<1	6	2.83	4	0	11
11948	Lake Waco Middle/South Bosque arm above SH6	5/18/2004	5	3	11	6.62	5	0	11

Appendix A
Ambient Water Quality Data

Station ID	Station Description	Date	Number of Samples	Minimum EC Conc*	Maximum EC Conc*	Geometric Mean EC Conc.*	Number of Samples with EC present	Number of Samples with EC Conc. > 394*	Total Suspended Solids (mg/L)
11953	North Bosque River at SH 56 near Valley Mills	5/18/2004	5	<1	80	1.38	1	0	8
11956	North Bosque River at FM 219 northeast of Clifton	5/18/2004	5	<1	26	1.10	1	0	3
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	5/18/2004	5	8	18	11.89	5	0	9
11921	Lake Belton near dam	6/21/2004	10	<1	<1	<1	0	0	<1
11922	Lake Belton Cowhouse Creek Arm	6/21/2004	5	<1	<1	<1	0	0	<1
11923	Lake Belton Leon River Arm near headwater	6/21/2004	5	<1	<1	<1	0	0	5
11925	Leon River at FM 1829	6/22/2004	5	<1	93	3.46	2	0	97
TBD4	Lake Belton Owl Creek Arm	6/21/2004	5	<1	2	0.76	2	0	19
11942	Lake Waco near dam	6/22/2004	10	<1	2	0.71	4	0	16
11945	Lake Waco North Bosque arm	6/22/2004	5	<1	13	6.24	4	0	26
11948	Lake Waco Middle/South Bosque arm above SH6	6/22/2004	5	<1	5	1.20	4	0	8
11953	North Bosque River at SH 56 near Valley Mills	6/22/2004	5	<1	<1	0.45	0	0	10
11956	North Bosque River at FM 219 northeast of Clifton	6/22/2004	5	<1	7	1.00	1	0	11
TBD3	Lake Waco Middle/South Bosque arm near inlet of Middle/South Bosque	6/22/2004	5	1	3	2.00	5	0	20

* *E. coli* (EC) Concentrations are reported in colony forming units in each 100 milliliters of water

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APPENDIX B
LABORATORY PROTOCOL FOR ISOLATION AND CONFIRMATION OF *ESCHERICHIA COLI* FROM WATER SAMPLES

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1. Follow the EPA Modified mTEC procedure described in USEPA Method 1603 (modified mTEC agar plate (USEPA Method 1603, http://www.epa.gov/nerlcwww/1603sp02.pdf) for isolation of *E. coli* colonies.

2. After the Modified mTEC 44.5±0.2°C incubation, the plates should be immediately stored at 4°C until shipment to prevent growth of non-*E. coli* coliforms on the plates.

3. Plates with red or magenta colored colonies should be parafilmed or taped closed, placed in plastic bags and then secured with tape to prevent the plates from being disturbed during shipment.

4. Ship plates in insulated coolers with ice packs sufficient to keep the plates between 1–4°C and ship by next day courier to:

   Dr. George D. Di Giovanni

   Texas A&M Agricultural Research and Extension Center

   1380 A&M Circle

   El Paso, TX 79927

   915-859-9111

5. Presumptive *E. coli* from the Modified mTEC plates will be isolated and confirmed as described in the protocol for fecal specimens.

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APPENDIX C
SUMMARY OF KNOWN FECAL SAMPLES COLLECTED FROM LAKE WACO AND BELTON LAKE WATERSHEDS

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Appendix C
Summary of Known Fecal Samples Collected

Lake Waco & Belton Lake Grouping	Animal		Sampling Lead Agency	Target No. Fecal Samples	Actual Collected Sep-03	Actual Collected Oct-03	Actual Collected Nov-03	Actual Collected Dec-03	Actual Collected Jan-04	Actual Collected Feb-04	Actual Collected Mar-04	Actual Collected Apr-04	Actual Collected May-04	Actual Collected Oct-04	Sum of Collected Fecal Samples	Negative Samples (did not produce at El Paso)	Potential Collection Areas	
Human																		
	human - raw sewage/influent WW		Parsons	140				40	56	36			60	39	231	55	head	human - raw sewage/influent WW
	human - septage w/o chemicals		Parsons	60						32				27	59		unloa	human - septage w/o chemicals
	human - treated WW effluent		Parsons	40				4							4	4	outfa	human - treated WW effluent
Pets																		
	cat		Parsons	25			2						19		21		cat	
	dog		Parsons	40				1		1	3		23	2	30	1	dog	
	other		Parsons	20													other	
		ferrets, gerbil, guinea pig	Parsons										3		3			ferrets, gerbil, guinea pig
		birds	Parsons												0			birds
		rabbit	Parsons			1							1		2			rabbit
Livestock																		
	cattle, dairy		TX Fm Bureau	60		1		14			40		15		70	7	cattle, dairy	
	cattle, beef		TX Fm Bureau	90		3		45			26	2	27		103	13	cattle, beef	
	chicken		TX Fm Bureau	15		2	3	4			4	1	2		16	8	chicken	
	turkey		TX Fm Bureau	5		3									3		turkey	
	horse		TX Fm Bureau	25		1		3			2	1	21		28	3	horse	
	goat, meat		TX Fm Bureau	15		3					7		23		33	2	goat, meat	
	goat, dairy		TX Fm Bureau	10							4				4	1	goat, dairy	
	sheep		TX Fm Bureau	25		2		1			27				30	3	sheep	
	llama		TX Fm Bureau			1									1		llama	
	pony, donkey		TX Fm Bureau			1							1		2		pony, donkey	
	guinea		TX Fm Bureau			1		3							4	3	guinea	
	pig/hog (domestic)		TX Fm Bureau	20		3					9		5		17		pig/hog (domestic)	
Wildlife (mammals/reptiles)																		
	racoon		Parsons	35			6	2		1	1	2	8	3	23	2	racoon	
	deer		Par+TxFB	40			17	5		1	3	6			32	5	deer	
	hog (feral)		Par+TxFB	20							1	2	1		4	2	hog (feral)	
	mouse		Par+TTU	15			1	2		1		3			[illegible]	7	mouse	
	rat		Par+TTU	15								1			[illegible]	1	rat	
	rabbit		Par+TTU	15		1	1		1	1	1	1	3		9	4	rabbit	
	opossum		Par+TTU	8		2	2	1	2		2	1		1	11	2	opossum	
	squirrel		Par+TTU	8		1	2	3			4	1	1		12	5	squirrel	
	armadillo		Par+TTU	8			1	1	1		1		3		7	1	armadillo	
	coyote		Anyone	5		1	1			1	11	6			20	1	coyote	
	fox		Par+TTU	5							1	1		1	3		fox	
	beaver		Par+TTU	2								2			2	1	beaver	
	nutria		Par+TTU	2											0		nutria	
	skunk		Par+TTU	5	1			1		1			1		4	1	skunk	
	bobcat		Anyone	2							1	1			2		bobcat	
	javalina		Anyone	1											0		javalina	
	other (exotics, cat (feral), etc.)		Anyone	20								1			[illegible]	1	other (exotics, cat (feral), etc.)	
Wildlife (bird/waterfowl)																		
	duck		Parsons	25		1	10					2	6	17	36	5	duck	
	swallow		Parsons	20			5					12			17	6	swallow	
	pigeon		Parsons	20		1	8							7	16	1	pigeon	
	heron		Parsons	15			5						1		6	2	heron	
	grackle		Parsons	15		1		1				1		17	20	1	grackle	
	turkey		Parsons	10			9				2	4			15	3	turkey	
	egret		Pars+Rehab	10									3		3		egret	
	martin		Parsons	10											0		martin	
	sparrow		Parsons	10								1			[illegible]	1	sparrow	
	dove		Parsons	10			5				1		1		7	2	dove	
	goose		Parsons	10		1	10						7		18		goose	
	other (birds)		Parsons	18													other (birds)	

Appendix C
Summary of Known Fecal Samples Collected

Lake Waco & Belton Lake Grouping	Animal		Sampling Lead Agency	Target No. Fecal Samples	Actual Collected Sep-03	Actual Collected Oct-03	Actual Collected Nov-03	Actual Collected Dec-03	Actual Collected Jan-04	Actual Collected Feb-04	Actual Collected Mar-04	Actual Collected Apr-04	Actual Collected May-04	Actual Collected Oct-04		Sum of Collected Fecal Samples	Negative Samples (did not produce at El Paso)	Potential Collection Areas
		wren	Parsons										1			1		wren
		warbler	Parsons										1			1		warbler
		cardinal	Parsons										3			3		cardinal
		crow	Parsons										1			1		crow
		blackbird	Parsons				6						1			7	4	blackbird
		meadowlark	Parsons				3	1								4	2	meadowlark
		cowbird	Parsons													0		cowbird
		mockingbird	Parsons			1										1		mockingbird
		flycatcher	Parsons													0		flycatcher
		snipe	Parsons				1									1	1	snipe
		vulture	Pars+Rehab					1		4	1					6	1	vulture
		killdeer	Parsons				2						1			3	1	killdeer
		hawk	Pars+Rehab													0		hawk
		owl	Pars+Rehab					1								1	1	owl
		starling	Parsons											15		15		starling
	other (waterfowl,shorebirds)		Parsons	18									1			1		other (waterfowl,shorebirds)
		cormoran	Parsons										1			1		cormoran
		swan	Parsons													0		swan
		pelican	Parsons				9									9	2	pelican
		seagull	Parsons				1									1		seagull
		plover	Parsons													0		plover
		crane	Pars+Rehab													0		crane
Zoo/Pettir	various		Parsons	13												0		zoo, carnival, petting zoo
	SUM			1000	1	32	110	134	60	79	152	52	245	129		994	166	
															ck	994		

All samples collected from this species were negative

No samples were collected from this species

Sum of Collected | Negative Samples

wildlife only:

APPENDIX D
LABORATORY PROTOCOL FOR ISOLATION AND CONFIRMATION OF *ESCHERICHIA COLI* FROM FECAL SPECIMENS

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Note: All collection and handling of fecal specimens should be performed using protective gear (i.e. latex or nitrile gloves). Specimens should be handled aseptically to ensure sample quality and minimize exposure of personnel to pathogens.

1. Fecal specimens should be refrigerated as soon as possible after collection and shipped in insulated coolers with ice packs sufficient to keep the specimens between 1–4°C. Ship by next day courier to:

   Dr. George D. Di Giovanni

   Texas A&M Agricultural Research and Extension Center

   1380 A&M Circle

   El Paso, TX 79927

   915-859-9111

Note: All handling of fecal specimens and cultures will be performed using a Class 2 biological safety cabinet to minimize the exposure of laboratory personnel to pathogens.

2. Using a bacteriological loop, streak a loopful of fecal material onto a labeled modified mTEC agar plate (USEPA Method 1603, http://www.epa.gov/nerlcwww/1603sp02.pdf) for isolation of *E. coli* colonies.

3. Invert the plate and incubate at 35±0.5°C for 2 h.

4. After the 2-h incubation at 35±0.5°C, incubate the plate inverted at 44.5±0.2°C for 20–24 h.

5. Examine the plate for presumptive *E. coli* colonies, which will appear red or magenta colored.

6. Select up to three presumptive *E. coli* colonies and streak each colony for purity onto a labeled nutrient agar with MUG (NA-MUG) plate.

7. Invert and incubate plates at 35–37°C for 20–24 h.

8. Examine the cultures using a long-wave handheld UV lamp. If there is a mixture of fluorescent and non-fluorescent colonies, select a well isolated fluorescent colony and streak again onto NA-MUG for purity.

At the discretion of the laboratory, additional biochemical tests such as urease, indole and citrate tests may be performed.

APPENDIX E
ARCHIVAL OF *ESCHERICHIA COLI* ISOLATES

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Note: All handling of cultures will be performed using a Class 2 biological safety cabinet to minimize the exposure of laboratory personnel to pathogens.

1. Select a well isolated colony of purified *E. coli.*

2. Using a bacteriological loop, transfer the colony to a labeled sterile cryovial containing 1 mL of tryptone soy broth (TSB) with 20% reagent grade glycerol. Verify that the cells have been resuspended.

3. Firmly cap the cryovial and plunge into liquid nitrogen until frozen.

4. Immediately transfer to a cryostorage box and place in -70 to -80°C freezer. Cultures may be stored for several years under these conditions.

5. To recover cultures from frozen storage, remove the cultures from the freezer and place the cryovials in a freezer block.

    a. Using a bacteriological loop, scrape the topmost portion of the culture and transfer to growth medium, being careful not to contaminate the top or inside of the vial.

    b. Reclose the cryovial before the contents thaw and return to the freezer.

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APPENDIX F
LABORATORY PROTOCOL FOR ERIC-PCR FINGERPRINTING OF *ESCHERICHIA COLI*

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Laboratory Protocol for Enterobacterial Repetitive Intergenic Consensus Polymerase Chain Reaction (ERIC-PCR) Fingerprinting of *Escherichia coli*

1. Select isolated colonies from overnight cultures of *E. coli* isolates on BHI plates.

2. Transfer colonies using 1 µL loop to sterile microfuge tubes containing 100 µL of sterile molecular grade water, vortex briefly to suspend cells.

3. Prepare sufficient PCR Master Mix for samples, including one blank per 10 samples to account for volume loss due to repeat pipetting. Prepare Master Mix for each sample as follows. One full PCR batch on the MJ Research Cycler 48 well-plate will have 46 samples, *E. coli* QC101, and a no template control (NTC).

ERIC-PCR Master Mix – 24 samples + 2 blanks

(prepare X 2 for full 48-well plate)

Table F-1 ERIC-PCR Master Mix

MASTER MIX	Amt (uL)	Final Calc	Final Units
dH2O	**31.5**		
10X PCR buffer I w Mg	**5**	1	X
20 mM dNTP	**0.5**	200	uM each
ERIC Primer Mix	**5**	600	nM each
BSA (30 mg/ml)	**2.5**	1.5	ug/uL
AmpliTaqGold (Units)	**0.5**	2.5	Units/rxn

4. Dispense 45 µl of Master Mix for each sample into the appropriate well of PCR plate.

5. Briefly vortex cell suspensions, then add 5 µl of each cell suspension to the appropriate PCR well.

6. Carefully seal plate using an adhesive PCR cover.

7. Load the plate into the thermal cycler and run under the "ERIC-PCR" program with the following cycling conditions:

   a. Initial denaturation at 95°C for 10 min
   b. 35 Cycles:

i. Denaturation at 94°C for 30 sec
ii. Annealing at 52°C for 1 min
iii. Extension at 72°C for 5 min

c. Final Extension at 72°C for 10 min

8. Store completed reactions at -20°C until analyzed by gel electrophoresis.

9. Prepare a 250 mL, 2% agarose gel using a 500 mL bottle. Add 250 mL of 1 X TBE buffer and 5.0 g agarose. Microwave until agarose is fully dissolved, tighten cap and let cool 1-2 minutes, then pour agarose into casting tray with 30-tooth, 1 mm thick comb.

10. Allow gel to solidify for approximately 30 minutes on the bench, then without removing comb place in Ziploc bag and solidify overnight in the refrigerator. The next day carefully remove comb, transfer to gel tank in cold room (4°C) containing pre-cooled 1X TBE buffer. Replace TBE in gel tank after it has been used twice.

11. The following items will be needed for electrophoresis:

100 bp ladder (0.33 μg/10 μL) (1500 μL final, enough for 150 lanes)

200 μL Roche DNA Marker XIV (Cat. #1721933) 0.25 μg/μL 100 bp ladder (add reagents below to a full tube of marker)

300 μL 6X ERIC-PCR loading buffer (see recipe below)

150 μL 10X PCR buffer

850 μL molecular grade water

Store in cold room

6X ERIC-PCR Loading Buffer

25 mg bromphenol blue (0.25%)

1.5 g ficoll 400 (15%)

Add molecular grade water to 10 mL, divide into 1 mL aliquots and freeze, the aliquot currently being used can be stored in the cold room

<u>ERIC-PCR Blank</u>

100 μL 10X PCR buffer

200 μL 6X ERIC-PCR loading buffer

900 μL molecular grade water

Store in cold room

<u>Ethidium Bromide Stain (0.5 μg/mL)</u>

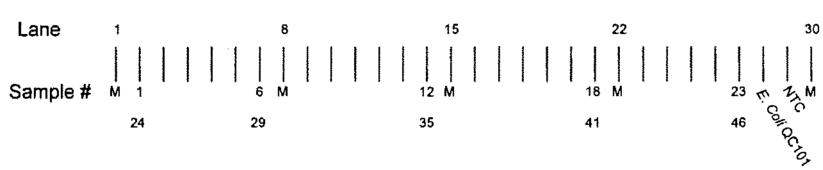
1250 mL 1X TBE

62.5 μL ethidium bromide (Sigma, 10 mg/mL)

Store covered at room temp, can use up to 5 times by adding 10 μL ethidium bromide each additional use

12. Mix 10 μL of 6X ERIC-PCR Loading Buffer to each PCR well and mix with pipette tip.

13. Load the gel in the cold room as follows (max. of 23 samples + QC101 + NTC per gel):
    a. Load 10 μl of 100 bp ladder (0.33 μg) into the first lane
    b. Load 10 μl of sample ERIC-PCR reactions into next 6 lanes
    c. Load 10 μl of 100 bp ladder (0.33 μg)
    d. Load 10 μl of sample ERIC-PCR reactions into next 6 lanes
    e. Load 10 μl of 100 bp ladder (0.33 μg)
    f. Load 10 μl of sample ERIC-PCR reactions into next 6 lanes
    g. Load 10 μl of 100 bp ladder (0.33 μg)
    h. Load 10 μl of sample ERIC-PCR reactions into next 5 lanes
    i. Load PCR Batch *E. coli* QC101 and NTC into next 2 lanes
    j. Load 10 μl of 100 bp ladder (0.33 μg)



If running a gel with fewer samples, follow steps above until last sample, followed by *E. coli* QC101, NTC and ladder, then load ERIC-PCR Blank into remaining lanes on gel.

14. Start electrophoresis power supply set at 100 volts, run for 1 hour.

15. Stop power supply, set time to "000", set voltage to 200 and start circulating pump at setting #2, run for 4 hours.

16. After electrophoresis, stain gel in Ethidium Bromide Stain for 20 minutes with agitation (save stain, see Step 13).

17. Destain gel for 10 minutes in 1X TBE buffer. Save destain, can be used 3 times then discard.

18. Follow Gel Logic 200 SOP for image capture. Save digital photograph as a TIFF file (default) and print a hardcopy for notebook.

APPENDIX G
SELECTION OF ISOLATES FOR LIBRARY INCLUSION BASED ON ERIC-PCR FINGERPRINTS

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Revised 12-20-04

Note: The terms "isolates" and BN "entries" are used interchangeably.

Ambient Water Isolates

1. At present, only 1 isolate per sample (in alphabetical order) is being analyzed by ERIC-PCR and RiboPrinting for the TCEQ San Antonio project, while all isolates from each water sample are being analyzed for the TSSWCB Waco project.

Source Sample Isolates

1. At least one isolate from each sample will be selected for RiboPrinting, even if it is identical to a previously selected isolate.
2. If there is only one isolate for a sample, select it for RiboPrinting – complete Step 7, then go to Step 10.
3. Select BioNumerics (BN) entries of all isolates for a single sample, create a temporary Comparison in BN (do not name or save).
4. Maximize the Comparison window and select the ERIC-PCR icon on the bottom menu bar to display the gel strips.
5. Click on the Dendrogram icon on the top menu bar, select Calculate Cluster Analysis, curve-based Pearson similarity coefficient and UPGMA Dendrogram. Sometimes you have to repeat steps 4 and 5 to get the Dendrogram to display.
6. Determine how many different ERIC-PCR fingerprint types there are (80% sim cutoff, i.e. <80% sim is unique, >80% sim is similar to previous entries). *Interpret the results, keeping in mind that isolates with visibly obvious identical banding patterns may cluster differently due to smearing in the lane when using curve based analyses. Consider these isolates the* <u>*same*</u> *ERIC-PCR type, and note "smear" after the information added to the Excel database in Step 4 below. Select the entry/isolate that does not have a smear in its lane for RiboPrinting, even if it is not in alphabetical order.* Designate, in order of abundance and alphabetically, the types as 1, 2 and 3. Example possible combinations for 1 to 3 isolates per sample are:

   1

   1, 1

   1, 1, 1

   1, 1, 2

   2, 1, 1

   1, 2

   1, 2, 1

   1, 2, 3

7. Enter the "ERIC-PCR Types" designation for each isolate entry into the Excel BN Import database.
8. Close the temporary comparison window without saving.
9. Select the BN entry of one representative isolate (in alphabetical order) of each ERIC-PCR type for that sample. For example, if Isolate A, B, C were ERIC-PCR Types 1, 2, 1, respectively, BN entries Isolates A and B would be selected.
10. Add entries to the Comparison list that contains only source isolates previously selected for RiboPrinting. The curve-based Pearson cluster analysis is automatically updated.
11. Determine if the added entries are unique or cluster with existing entries (80% sim cutoff, i.e. <80% sim is unique, >80% sim is similar to previous entries). Each isolate that is unique should be selected for RiboPrinting. *Use some judgment here – if all or a majority of the isolates appear to be unique (<80% sim to existing entry), please contact Dr. Di Giovanni.*
12. If all of the isolates from a sample cluster with existing entries, select one isolate (in alphabetical order) from the most abundant ERIC-PCR type for that sample (e.g. Isolate A from example given in Step 6 above). Also, each cluster should be composed of at least two entries. Therefore, if an isolate is >80% similar to a *single existing entry* it should be selected for RiboPrinting, regardless of the selection of other isolates from the same sample. If all isolates are already represented in the BN selected database ("Library" for the watershed), then select the isolate that is least represented in the database.
13. Designate the isolate(s) to be RiboPrinted in the Excel BN Import database, save.
14. Remove the unwanted entries from the Comparison window (*not the database*), the dendrogram is automatically updated. Save the updated comparison.
15. Repeat for isolates from the next sample.

1. When finished with a gel, go and update the Main Excel database with the ERIC-PCR types and Isolates to be RiboPrinted information.

APPENDIX H
LABORATORY PROTOCOL FOR AUTOMATED RIBOTYPING OF *ESCHERICHIA COLI* USING THE DUPONT QUALICON RIBOPRINTER

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Storing and Handling Disposables

Check the lot expiration date on each label for details and rotate the stock to optimize use.

Heating MP Base

After storage and the temperature changes that occur during shipment, the oxygen in the buffer loaded in the MP base may need to be removed before use. This is called degassing and is accomplished by heating the base pack overnight in your incubator.

To degas buffer:

1. Place enough MP base packs for the next day's production in their storage pouches in an incubator set at 37°C.
2. Allow the base pack to degas for 16-24 hours prior to loading in the characterization unit. You may do this while you are incubating samples, since the base packs are sealed in their pouches. This procedure allows you to start a batch immediately at the beginning of the next shift.
3. If you do not use the heated base packs, you can return them to storage and reuse them. These base packs should be heated again before reuse since temperature cycling affects oxygen content in the buffer.

Preparing Lysing Agent

Lysing agent (A and B) is shipped frozen and must be stored at -20°C.

Lysing agent must be thawed before use. This only takes about 5 minutes. If the lysing agent will not be used again for more than 2 hours, the material should be returned to the freezer. Lysing agent can be re-frozen several times with no effect on performance.

Sample Preparation Procedures

1. Incubate and Inspect the Samples

Use BHI (Brain-Heart Infusion) agar plates prepared within the last 30 days. Do not use plates that appear dry or dehydrated. Such plates can cause problems when you attempt to "pick" the colonies for use in the RiboPrinter® system.

1. Using a pure isolated colony as the source, streak BHI agar plates heavily in the upper portion of the plate to create a lawn. Streak the remainder of the plate lightly to create single colonies.
2. Follow standard laboratory techniques. Heat plates for 18-30 hours in a humidified incubator at 37 °C.

2. Transfer Sample Buffer to Intermediate Tubes

1. Locate the 250 mL twist-top bottle of sample buffer supplied in Pack # 1 Install the twist cap.
2. Transfer about 5 mL of buffer to a sterilized disposable 15 mL intermediate working tube.

3. Add sample buffer to microcentrifuge tubes

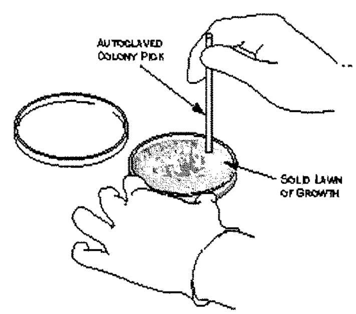
1. Place a sterile 0.65 mL microfuge tube in each of the eight holes in the lower row of the sample preparation rack.
2. For Gram negative samples (including *E. coli*), add 200 µL of sample buffer from the intermediate tube.

For Gram positive samples (*e.g. S. aureus* and *L. innocua* QC strains), add 40 µL of sample buffer.

3. Close the lids on the tubes.

4. Harvest the Samples

1. Using autoclaved colony picks and making certain not to gouge the agar, carefully place the pick into one of the single colonies or the lawn. You need a sample area at least equal to that of the bottom of the colony pick. In most cases you will need to harvest from the lawn area of the plate. If you are working with large colonies, a single colony will be adequate.



2. For Gram negative samples (e.g. *E. coli*), perform 1 pick placed into 200 µL of sample buffer.

CAUTION! Do not try to use the same pick twice on a plate. You need to harvest only enough sample to cover the bottom surface of the pick. Make sure the end of the pick is flat, if not, use a different pick.

CAUTION! Do not overload the harvesting pick. Collect only enough sample to cover the base of the pick. Over sampling will cause inaccurate results. Over sampling is a particular problem with *Staphylococcus*.

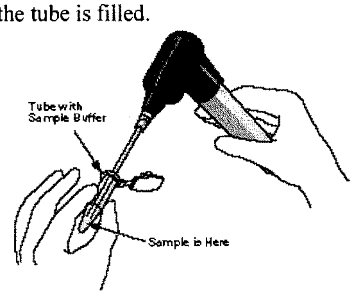
5. Mix the Samples

WARNING! *Perform sample preparation using a Class 2 biological safety cabinet since aerosols may be formed during mixing of the samples.*

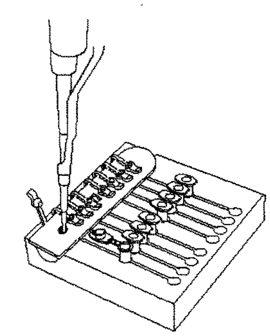
1. Making certain not to touch the sample end of the pick, place the pick into one of the filled sample tubes.
2. While holding the tube with the open end facing away from you, carefully attach the pick to the hand-held mixer. The fit of the pick in the coupling will be loose.

WARNING! Do not turn on the mixer unless the pick is inside the sample tube and below the surface of the liquid. Turning the unit on at other times will cause the sample to aerosolize and may cause contamination.

3. Press the ON lever on the mixer for about 5 seconds.
4. Release the lever and carefully remove the colony pick. The sample liquid should appear turbid.
5. For **Gram positive samples only**, (e.g. *Staphylococcus* and *Listeria*) locate a new colony pick and repeat the steps for harvesting and mixing samples, adding a second sample to the original tube. Discard the used picks in a biowaste bag.
6. Cap the sample tube.
7. Move the tube to the top row of the sample preparation rack. This indicates that the tube is filled.



6. Transfer the Samples to the Sample Carrier



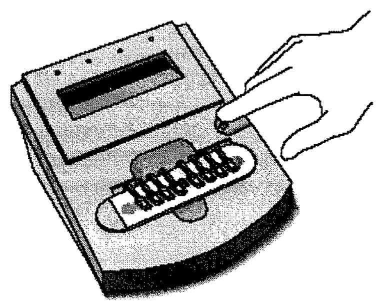
1. Open the lid covering the first well of the sample carrier.
2. Using a 100 µL pipetter, pipette 30 µL of sample from the microcentrifuge tube into the well.
3. Close the lid cover for the well.
4. Repeat for remaining samples using a new pipet tip for each sample.

CAUTION! Transfer the sample carrier to the Heat Treatment Station within 2 hours. If you wait longer than 2 hours, you will have to discard the sample carrier and begin again for this batch.

6. Lightly wipe down the outer surfaces of the sample carrier with a lab wipe wetted with surface disinfectant (10% bleach or 70% alcohol).
7. Write down the name or code you use to identify the sample and the well number in the sample carrier for each sample using a sample log sheet.

7. Place the Sample Carrier in the Heat Treatment Station and Process the Sample Carrier

1. Place the sample carrier into the Heat Treatment Station. The display on the Heat Treatment Station will show **Insert**, if power is available. If the display is blank, make certain that the power cord on the back of the station is properly connected.



   After you insert the carrier, the display shows **Press Button.**

2. Press the button on the Heat Treatment Station.

   The display shows **Warm up** and counts down from **10** while the station is warming up. The actual warm up cycle varies with the condition of the room and the heat treatment station. Normal time is about 4 minutes.

   When the station reaches operating temperature, the display changes to **Heat** and counts down from **13.** This represents each minute of heat treatment.

   The indicator message changes to **Cool.** The display counts down from **9,** indicating the minutes remaining in the cooling cycle. If necessary, you can remove the carrier as soon as the **Cool** message appears.

3. The heat treatment step is finished when the display shows **READY** and counts down from **90.** The display will flash and an audible beep will sound three times. The alarm will then beep once every 10 minutes until the sample is removed or 90 minutes elapses.

Caution! The heat-treated samples must be used within the 90-minute period at room temperature or they must be discarded. The heat-treated samples may be stored at this point (prior to adding Lysis Agents) for 1 week at 4 °C, or for several months at -70 °C.

8. Add the Lysing Agents

1. Using a 10-µL pipetter and new tips for each addition, add 5 µL of Lysing Agents A and B to each sample. Note: this step may be omitted for *E. coli* if no effect on ribopatterns is demonstrated. Lysing Agents were specifically developed for *Staphylococcus* and Lactic-Acid bacteria samples.

Caution! This step must be performed just prior (within 10 minutes) of loading the samples into the RiboPrinter and starting the run.

Creating and Loading a Batch

There are three options under the Operations menu for creating standard batches;

- *EcoR*I batches (VCA)
- *Pst*I batches (VCB)
- *Pvu*II batches (VCC)

You can also create special batches:

- Restriction Enzyme Flexibility batches
- **Substitute Enzyme batches (including *Hin*d III)**

From the Instrument Control Base Window:

1. Move the pointer to Operations and click with the mouse button. The Operations menu appears.
2. Move the pointer to Create Substitute Enzyme Batch and click with the mouse button.
3. Use the View menu to remove any optional items you do not wish to fill in. The system requires at least Sample Type and RiboGroup Library information for each sample. You cannot remove these options. The **Clear** option de-selects the **Use Default ID Libraries.** You will have to enter a DuPont ID and Custom ID library name for all samples. These become required fields and the system will make you enter data before you can save the information in this window.

CAUTION! If you change the display after you have entered information, you will lose all the information in the window. The window will redraw with a new blank display showing the items you have selected.

4. To enter information about the sample, click on the **View** button with the mouse button, then click on **Sample Items**. Click on the options you want to display.
5. Enter your initials and any comment you want to record about the batch.
6. Select the lot number fields and record for all reagents.

CAUTION! All fields must be completed or the system will not let you start processing the batch.

7. For each well in the sample carrier, choose the type (Sample or Control [QC Number]) from the Sample Type field. The system defaults to Sample.
8. Once you define the Sample Type as Sample, type in the name you actually want to use. This information will appear as Sample Label in the Data Analysis software screens.
9. You can change the RiboGroup library name if needed. Do this by clicking on the button next to the field with the mouse button. A pop up menu appears listing your choices. If you want to add a new library name, move the pointer to the line and click with the mouse button to get a cursor, then type in the new library name. Once you have saved this file, the new name will be added to the pop up list for future use. Do **NOT** change the DuPont ID field. If you select one of the QC strains, the system automatically enters QC in the DuPont ID and RiboGroup Library fields. Do not change these names. If you wish, you may enter a name for the Custom ID library.
10. Repeat for the other seven samples.
11. Click on Save and Submit Batch to Instrument.

Loading Disposables

Follow the screen prompts to load disposables and check the DNA Prep Waste. The icons on the window will flash red to tell you to remove and load an item. The screen prompts you about which Separation and Transfer chamber to use for the membrane and gel cassette. The LDD Pipette will move to physically block you from placing samples in the wrong chamber.

CAUTION! *Do not try to move the pipette manually. You will cause the system to lose the step count. This can result in the loss of batch data. If the pipette is blocking the S/T chamber that you are instructed to use, STOP. Call Customer Support.*

CAUTION! *Do not load disposables until you are prompted by the system. If you try to load them earlier, the alarm will sound as long as the doors are open. If you do load disposables ahead of time, the MP Base will be moved to the wrong position and you will not be able to begin processing the batch. You will not be able to move the MP base manually.*

1. Check the DNA Preparation Waste Container

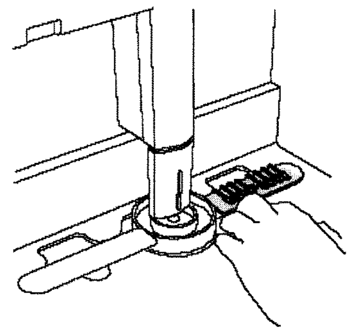
1. The DNA Prep waste container must be visually checked before every batch. If the container looks nearly full (about 1 inch from the top), remove the container, unscrew the cap and empty into the liquid biohazard waste.

WARNING! Do not tip the DNA Preparation waste container when you remove it.

WARNING! Do not unscrew the cap from the DNA Preparation waste container if the fluid level has risen into the cap. First pour the excess waste liquid into the liquid biohazard waste.

WARNING! When replacing container make sure that the cap is properly threaded in place. If the cap is only partially threaded, it can snag the pipette during operation.

2. Load the Sample Carrier



1. Place the sealed carrier into the labeled slot on the far right of the characterization unit.
2. Push the sample carrier down firmly until it snaps into place.

CAUTION! Place the rounded edge of the sample carrier on your right as you view the characterization unit. Position the carrier this way to insure correct identification of the sample wells.

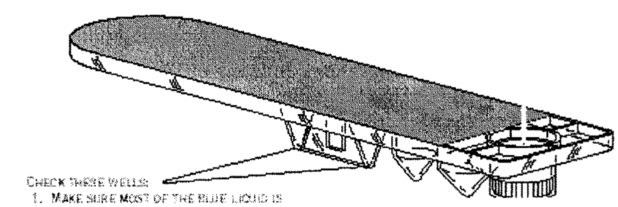
3. Load the DNA Prep Carrier

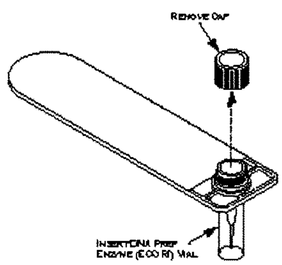
1. Remove the DNA Prep carrier from the refrigerator.
2. Check the wells in the carrier. If most of the liquid appears to be in the bottom of the wells and there are no bubbles, go to step 3. Otherwise **lightly tap the side of the carrier a few times with your finger to release any material that has adhered to the lid.**
3. CAUTION! Do not tap the carrier briskly. This may cause the marker to degrade which can create inaccurate results.
4. Remove a vial of DNA Prep Enzyme (*Hin*d III or *Eco*R I) from the freezer. ***Hin*d III (NEB Cat. #R0104M) is prepared in a Sarstedt 500-µL microfuge tube (Cat. #72730-005) as either a 100 or 50 U/µL working stock as follows.**

   <u>100 U/µL:</u> 50 µL *Hin*d III and 3 µL of NEB Buffer 2

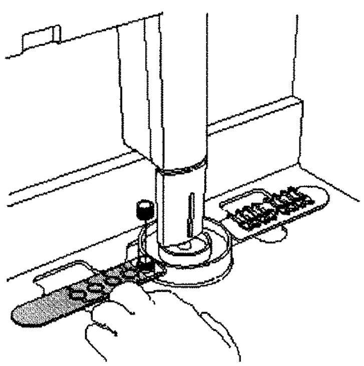
   <u>50 U/µL:</u> 26.5 µL *Hin*d III and 3 µL of NEB Buffer 2

   During addition of the Buffer, mix enzyme and buffer to homogeneity by stirring with the micropipette tip.



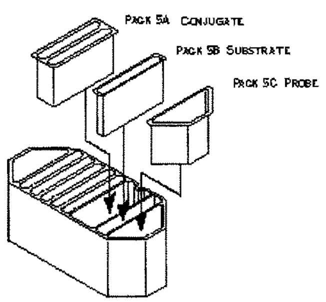


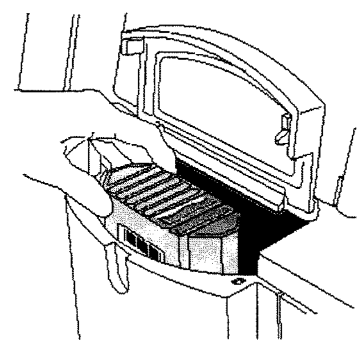
5. Remove the cap from the Enzyme vial.
6. Insert the vial into the carrier.
7. Place the DNA Prep carrier into the slot labeled **Reagent** to the left of the sample carrier slot.
8. Push the DNA Prep carrier down firmly until it snaps into place.



4. Load the MP Base and Carousel

1. Unpack the disposables.
2. Remove the MP base (Pack 5) from the incubator and the Conjugate (Pack 5A), Substrate (Pack 5B), and Probe (Pack 5C) from the refrigerator.
3. Remove each insert from its pouch. Tap the powdered reagent packs gently to bring all powder to the bottom of the packs. Place reagent packs in the MP base and load the base in the carousel.

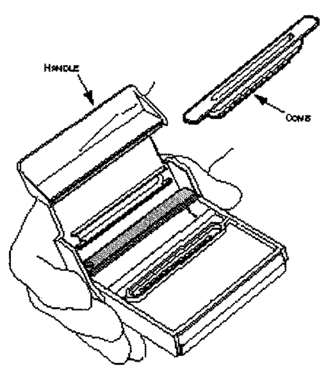


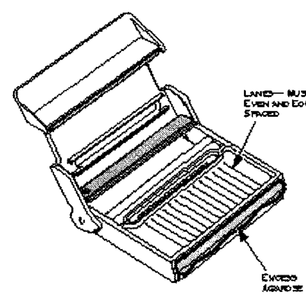


CAUTION! Push each insert firmly into place. If part of the insert extends above the top of the base, it could catch on the bottom of the deck and cause a system error. You could lose one or more batches as a result. Each insert is keyed by shape and cannot be inserted incorrectly.

5. Load the Gel Cassette

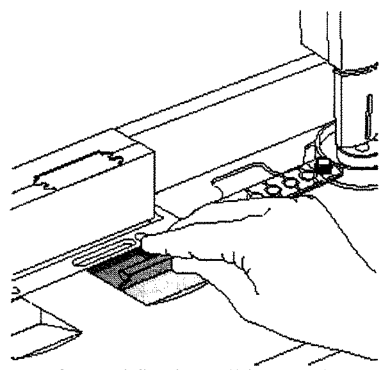
1. Remove the gel cassette from its package.
2. Grasp one end of the rubber comb and gently pull the comb from the cassette.
3. Unfold the handle of the cassette towards you until the handle snaps into place.
4. Check the front edge of the gel cassette and the lanes of the gel.





Warning! *If the cassette shows a build up of excess gel on the front edge, or if you notice any shrinkage of the gel away from the cassette or bubbles, record the lot number and call Customer Support. Use a new cassette for this run.*

5. Insert the gel cassette into the slot labeled **Gel Bay.** The RiboPrinter® system will prevent the insertion of the cassette into the incorrect slot by blocking one slot with the LDD Pipette.

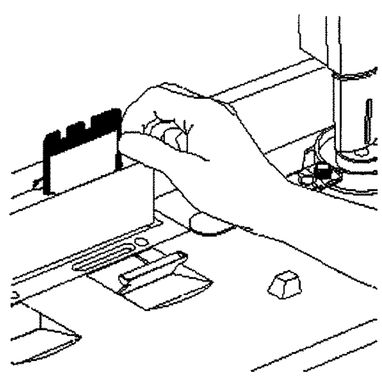


6. Press the cassette forward firmly until it snaps into place.

6. Load the Membrane

1. Grasp the membrane and carefully drop it into the front slot and flip the metal bracket against the back of the membrane.

CAUTION! You can insert the membrane backwards. This will cause an alarm that prevents the sample from being processed until the error is corrected. Always make certain that the two large slots are on top and that the square hole on the side faces your left as you insert the membrane.



7. Close all doors and the instrument will begin sample processing.

8. Load the Next Batch

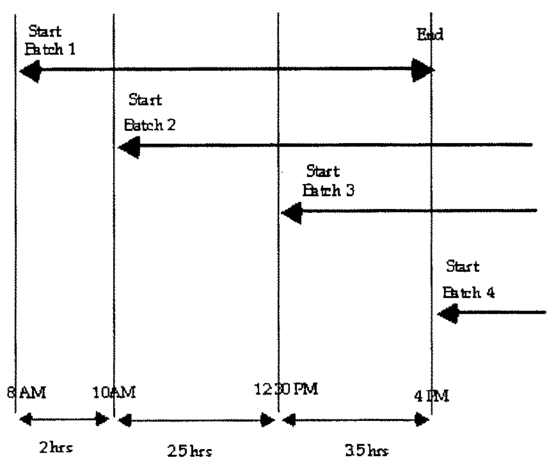
The RiboPrinter® microbial characterization system lets you load up to four VCA batches in an eight hour period. **Other batches** may take longer to process.

The chart above shows the approximate loading times for each batch in a work shift using only the VCA protocol.

1. You can now use the **Create Batch** option to set up a new pending batch.
2. When you complete the information window and click on the **Start Normal Batch** option, the window displays a message telling you when you can load the next batch.

Batch Report

After image processing is completed, the system automatically runs a series of analysis functions and generates a Batch Information Report. This task does not require any action on the part of the operator. Reports are automatically saved to the hard disk of the computer and sent to the printer.



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APPENDIX I
LABORATORY PROTOCOL FOR MOLECULAR SUBTYPING OF *ESCHERICHIA COLI* BY PULSE FIELD GEL ELECTROPHORESIS (PFGE)

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Day 0 – Bacterial cultures

Streak overnight broth culture of TSB onto TSA for confluent growth using inoculating loop. Incubate cultures at 37° C for 14-18 hrs.

Day 1 – Preparation of agarose plugs (This part will be performed during the lab session of September 27)

1. Prepare 1% SeaKem Gold:1% SDS agarose in TE Buffer (10mM Tris:1mM EDTA, pH-8.0). Melt agarose in microwave and store in 55° C water bath until use.
2. Transfer 5 ml of Cell Suspension Buffer (CSB) (100mM Tris:100 mM EDTA, pH-8.0) to tubes. Use sterile cotton swab that has been moistened with CSB to remove confluent growth from agar plates; suspend cells in CSB by spinning swab gently to disperse cells.
3. Adjust concentration of cell suspension to Optical Density value of 1.35 at 610nm wavelength of light using a spectrophotometer. Concentration of cells can be changed by adding cells or CSB as needed.
4. Transfer 0.4 ml adjusted cell suspension to 2 labeled 1.5-ml microcentrifuge tubes at room temperature.
5. Add 20ul of Proteinase K (20mg/ml stock) to each tube and mix gently with pipet tip. Proteinase K should be maintained in ice and stored at -20° C
6. Add 0.4 ml melted % SeaKem Gold:1% SDS agarose to the 0.4 ml cell suspension; mix by gently pipetting mixture up and down a few times. Maintain temperature of melted agarose by keeping flask in 55° C water bath.
7. Immediately, dispense part of mixture into appropriate wells of plug mold (~0.4 ml per plug). Make two plugs per specimen. Allow plugs to solidify at room temperature for 10 min.
8. Prepare Cell Lysis Buffer (50 mM Tris: 50 mM EDTA, pH 8.0 + 1% Sarcosyl). Calculate the total volume of Cell Lysis/Proteinase K Buffer needed as follows:
    a. 5ml of Cell Lysis Buffer plus 25ul Proteinase K Stock Solution (20mg/ml) per tube.
    b. Measure correct volumes into appropriate size test tube or flask and mix well.
9. Add 5 ml of Proteinase K/Cell Lysis Buffer to a screw-cap tube for cell lysis of plugs.
10. Transfer plugs from plug molds into tubes containing Proteinase K/Cell Lysis Buffer. Place tubes into rack in 54° C shaker water bath for 1.5 hrs.
11. Pre-heat sterile reagent grade water to 50° C so that plugs can be washed two times with 10 ml of water
12. Remove tubes from water bath and pour off lysis buffer into discard container.

13. Add 10 ml of sterile Pre-heated water to each tube and shake tubes in 50° C Water bath for 10 min.
14. Pour off water from the plugs and repeat wash steps once more. Pre-heat TE Buffer (10mM Tris:1mM EDTA, pH-8.0) in 50° C water bath so that the plugs can be washed four times with 10 ml of buffer.
15. Pour off water and add 10 ml pre-heated TE buffer and shake vigorously in 50° C water bath for 10 min.
16. Pour off TE and **repeat wash steps three more times.**
17. Decant last wash step and add 5 ml TE. Store plugs at 4° C until restriction digest.

Day 2 - Restriction digestion of DNA in agarose plugs with XbaI

1. Dilute 10X H Buffer (Roche Molecular Biochemicals) 1:10 with sterile reagent grade water.
2. Add 200 ul diluted H buffer to labeled microcentrifuge tube. Carefully remove plugs from TE with spatula and place in sterile disposable Petri dish.
3. Cut 2.0 mm Slice from plug with scalpel and transfer to tubes with diluted H buffer. Replace remaining plug into TE buffer and store at 4° C.
4. Incubate sample and control plug slices in 37° C water bath for 5 min.
5. After incubation, carefully remove buffer from plug slice using a micropipettor. Dilute 10X H buffer 1:10 and add XbaI restriction enzyme (50U/Sample). Mix thoroughly.
6. Add 200 ul restriction enzyme mixture to each tube. Close tube and mix by tapping gently.
7. Incubate sample and control plug slices in 37° C water bath for 1.5 hrs.
8. Cast agarose gel by preparing 1% SeaKem Gold agarose in 0.5X TBE buffer. Melt agarose completely and place in 50° C water bath until use.
9. Carefully pour agarose into level gel form fitted with comb.
10. Place black gel frame in electrophoresis chamber. Add 2.2 L freshly prepared 0.5X TBE.
11. Turn on cooling unit (14° C) and pump (set at 70 for 1 liter/min flow rate).
12. Remove restricted plug slices from 37° C water bath. Remove enzyme/buffer mixture and add 200 ul 0.5X TBE. Incubate at room temperature for 5 min.
13. Remove comb after gel solidifies for 30 min.
14. Remove restricted plug slices from tubes and load into appropriate wells with spatula. Make sure there are no air bubbles.

15. Cover plugs and fill wells with remaining melted 1% SeaKem Gold agarose. Allow to harden for 5 min. Unscrew end gates from form; remove excess agarose from sides and bottom of stand with a Kimwipe. Carefully place gel inside black gel frame in electrophoresis chamber. Close cover of unit.
16. Run electrophoresis user program 1 in unit.

Day 3 - Restriction digestion

1. When electrophoresis is over, turn off equipment and stain gel with Ethidium Bromide (0.5 ug/ml) made in 400 ml of 0.5X TBE. Stain for 30 min with agitation.
2. Pour off Ethidium Bromide solution and place gel in 400 ml of 0.5X TBE to destain for 15 min. After 15 min. pour off TBE and add fresh 0.5X TBE and continue destaining for 15 min.
3. Place gel on UV light box and photograph using Kodak CDC and software. Save digital photograph and print hardcopy for notebook.

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APPENDIX J
LABORATORY PROTOCOL FOR ANTIBIOTIC RESISTANCE ANALYSIS BY THE KIRBY-BAUER DISK DIFFUSION METHOD

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The Kirby Bauer Disk Diffusion Method is described in the following document from the NCCLS: *Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard-2nd edition (2002). M31-A2 Vol. 22 No. 6.* A copy of this method is available upon request.

Cryofrozen samples (a bacterial suspension of 0.4 mL of 80% glycerin and 20% water and 0.6 mL of purely isolated *E. coli* in nutrient broth) in 1.0 mL plastic cryovials were delivered overnight to TAMU-CC, from Texas A&M El Paso Agricultural Research and Extension Center, in styrofoam boxes packed with dry ice. TAMU-CC received shipments of samples on 3/26/2004, 7/29/2004, 8/11/2004, 10/5/2004, 1/19/2005, 2/4/2005, 4/15/2005, and 6/27/2005. The samples were immediately inventoried and the date, time, sample identification numbers, temperature, and signature of the receiver were recorded on laboratory sample reception logs. The samples were then stored at -80° C. for later analysis.

Before antibiotic resistance analysis, the frozen isolates were aseptically transferred from the cyrovials onto tryptic soy agar (TSA) plates and incubated overnight (18-24 hr) at 35° C. Each isolate was transferred to tryptic soy broth (TSB) and incubated in a 35° C shaker for 2-6 hours. Antibiotic resistance analysis of the isolates was performed by the standard Kirby Bauer Disk Diffusion method, with a panel of 20 antibiotics (Table J-1), following NCCLS Performance Standards (2000, 2002a, 2002b). Two Mueller Hinton Agar plates were used per isolate, with 10 antibiotics per plate. After incubation the plates were analyzed with an automated plate reader, the BIOMIC® system, which uses color digital image analysis to provide instantaneous reading of inhibition zone diameters and interpretation following NCCLS M100 (2002b). The BIOMIC® system includes software to determine whether each isolate is resistant, intermediate or susceptible (R-I-S) based on published NCCLS guidelines (TableJ-2). The automated image analyzer ensured uniformity for future comparisons with *E. coli* isolates from unknown sources as detailed in the TAMU-CC SOP following NCCLS (2002a), approved in the QAPP for the project (2003). The results were stored electronically in the BIOMIC® system database, and as hard copy in binders, with back up CDs.

American Public Health Association. 1998. Standard methods for the examination of water and wastewater. 20th ed. American Public Health Association, Washington D.C.

NCCLS (2000) Performance Standards for Antimicrobial Disc Susceptibility Tests; Approved Standard-Seventh Edition. NCCLS document M2-A7.

NCCLS (2002a) Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard-Second Edition. NCCLS document M31-A2.

NCCLS (2002b) Performance Standards for Antimicrobial Susceptibility Testing; Twelfth Informational Supplement. NCCLS document M100-S12

Table J-1 Antibiotics used to develop antibiotic resistance profiles for *E. coli* isolates

Antibiotic	Abbreviation	Concentration
Ampicillin	AMP	10 µg
Augmentin	AMC	30 µg
Cefazolin	CZ	30 µg
Cefotaxime	CTX	30 µg
Ceftazidime	CAZ	30 µg
Ceftriaxone	CRO	30 µg
Chloramphenicol	C	30 µg
Ciprofloxacin	CIP	5 µg
Doxycycline	D	30 mg
Enrofloxacin	ENO	5 µg
Gentamicin	GM	10 µg
Imipenem	IPM	10 µg
Kanamycin	K	30 µg
Nalidixic acid	NA	30 µg
Neomycin	N	30 µg
Spectinomycin	SPT	100 µg
Streptomycin	S	10 µg
Sulfamethoxazole Trimethoprim	SXT	23.75/1.25 µg
Sulfisoxazole	G	0.25 mg
Tetracycline	Te	30 µg

Table J-2 Susceptible (S), Intermediate (I), and Resistant (R) ranges (mm) for *E. coli* using the BIOMIC Microbiology Analyzer System

Antibiotic	S	I	R
AMP	≥ 17	14-16	≤ 13
AMC	≥ 18	14-17	≤ 13
CZ	≥ 18	15-17	≤ 14
CTX	≥ 23	15-22	≤ 14
CAZ	≥ 18	15-17	≤ 14
CRO	≥ 21	14-20	≤ 13
C	≥ 18	13-17	≤ 12
CIP	≥ 21	16-20	≤ 15
D	≥ 16	13-15	≤ 12
ENO	≥ 21	16-20	≤ 15
GM	≥ 15	13-14	≤ 12
IPM	≥ 16	14-15	≤ 13
K	≥ 18	14-17	≤ 13
NA	≥ 19	14-18	≤ 13
N	≥ 17	13-16	≤ 12
SPT	≥ 18	15-17	≤ 14
S	≥ 15	12-14	≤ 11
SXT	≥ 16	11-15	≤ 10
G	≥ 7	NA	≤ 6
TE	≥ 19	15-18	≤ 14

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APPENDIX K
BST WORKSHOPS STAKEHOLDERS LIST

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BST WORKSHOP ATTENDEE LIST

June 27, 2003

AGENCY	NAME	TITLE
Project Team		
Texas Farm Bureau	Ned Meister	Director, Commodity & Regulatory Activities
Parsons	Mel Vargas	Project Manager
Parsons	Kirk Dean, Ph.D.	Technical Manager
TSSWCB	Kevin Wagner	Project Manager
EP AREC, Texas A&M	George Di Giovanni, Ph.D.	Assoc. Prof, Environmental Microbiology
Texas A&M College Station	Suresh Pillai, Ph.D.	Assoc. Prof., Food and Environmental Microbiology
Texas A&M Corpus Christi	Joanna Mott, Ph.D.	Assoc. Prof, Physical & Life Sciences
City of Waco	Tom Conry	Program Administrator, Lab & Watershed Programs
Brazos River Authority	Kyle Headley	Regional Environmental Planner, Central Basin
State Agencies		
TCEQ	Margaret Hoffman	Executive Director
TCEQ	Mason Miller	TMDL Technical Director
TDH	James Morgan	Regional Director, M.D.
TPWD	Pat Radloff	Water Quality Team Leader
TX Dept Ag.	Bo Spoonts	
TX Dept Ag.	Lisa Eldridge	
TXDOT	Barrie Cogburn	Landscape Architect
Universities		
Texas A&M	Allan Jones	Director, TX Water Resources
TIAER	Larry Hauck	Assoc. Dir. Environ. Sciences
Baylor	Owen Lind	
Federal Agencies		
USEPA Region 6	Shawneille Campbell	Texas TMDL Coordinator
USEPA Region 6	Philip Crocker	
USDA – NRCS	Tim Buscha	
USDA – NRCS	James Abbott	
USGS	Jess Weaver	District Chief
U.S. Congress	Chet Edwards	Congressman
Ft. Hood Environ	Riki Young	Biologist
USACE	Jeff Tripe	Environmental Planner
Regional Entities		
Brazos River Auth	John Baker	Middle Basin Manager
SWC District-Hamilton-Coryell	B.W. Teague	Chairman
SWC District – Bell	B.G. Welch	Chairman
SWC District – McClennan	Max Sturdivant	Chairman
SWC District – Bosque	Phillip Munden	Chairman

AGENCY	NAME	TITLE
SWC District – Erath	Donald Smart	Chairman
SWC District – Comanche/Eastland/Erath	Norman Moore	Chairman
Local Citizens		
Local Citizens	Truman Blum	
Local Citizens	John Merrill	TX & SW Cattle Raisers Assn
Local Citizens	John Hatchell	
Dairy Farmers and Ranchers by Watershed		
Dairy Farmers of America	John Cowan	
Farm Bureau – McLennan Co.	Robert Rush	President
Farm Bureau – Bell County	Robert Fleming	President
Farm Bureau – Bosque County	Alan Day	President
Farm Bureau – Coryell County	Neil Walter	President
Farm Bureau – Hamilton County	Rusty Harris	President
Farm Bureau – Erath County	Jimmy Holeman	President
Cities by Watershed		
Watershed – Leon River – Gatesville	Brandon Emmons	City Manager
Watershed – Leon River – Temple/Belton	Mark Watson	City Manager
Watershed – Bosque – Waco	Ricky Garrett	Water Treatment Superintendent
Watershed – Bosque – Clifton	Jerry Golden	City Administrator
Watershed – Bosque – Stephenville	John Moser	Mayor
Watershed – Bosque – Meridian	Marie Garland	Public Works Director
County Judges		
County Judge – Bosque	Cole Ward	County Judge
County Judge – Erath	Tab Thompson	County Judge
County Judge – Coryell	John Hull	County Judge
County Judge – Comanche	James Arthur	County Judge
County Judge – McLennan	Jim Lewis	County Judge
County Judge – Bell	Jon Burrows	County Judge
County Judge – Hamilton	Fred Cox	County Judge

BST WORKSHOP ATTENDEE LIST

October 27, 2005

AGENCY	NAME	TITLE
Project Team		
Texas Farm Bureau	Ned Meister	Director, Commodity & Regulatory Activities
Parsons	Mel Vargas	TMDL Technical Director
Parsons	Kirk Dean	Principal Scientist
TSSWCB	T.J. Helton	NPS Grant Coordinator
EP AREC, Texas A&M	Elizabeth Casarez, Ph.D.	Postdoctoral Res. Assoc., Environmental Microbiology
Texas A&M College Station	Suresh Pillai, Ph.D.	Professor, Food and Environmental Microbiology
Texas A&M Corpus Christi	Joanna Mott, Ph.D.	Assoc. Prof, Physical & Life Sciences
City of Waco	Tom Conry	Program Administrator, Lab & Watershed Programs
Brazos River Authority	Dr. John Ellis	Regional Environmental Planner, Central Basin
State Agencies		
TCEQ	Mark Vickery	Deputy Executive Director
TCEQ	Jim Davenport	Water Quality Standards
TCEQ	Faith Hambleton	TMDL Program Manager
TCEQ	Robbie Ozment	TCEQ Region 9 Water Quality Specialist
DSHS	James K. Morgan, MD, MPH	Public Health Regional Director
TPWD	Pat Radloff	Water Quality Team Leader
TX Dept Agriculture	Richard Eyster	Hydrogeologist
TXDOT	Barrie Cogburn	Landscape Architect
Universities		
Texas A&M	Allan Jones	Director, TX Water Resources
TIAER	Larry Hauck	Assoc. Dir. Environmental Sciences
Baylor	Renee Massengale	Associate Professor
Baylor	Owen Lind, Ph.D.	Professor of Biology
Federal Agencies		
USEPA Region 6	Shawneille Campbell	TMDL Coordinator
USEPA Region 6	Philip Crocker	Water Quality Assessment Sect. Manager
USDA – NRCS	Claude Ross	State RC&D Coordinator
USGS	Bob Joseph	District Chief
USGS	Ann Ardis	Hydrologist
USGS	Michael Canova	Hydrologist
U.S. Congress	Chet Edwards	Congressman
Texas State Senate	Kip Averitt	Texas State Senator, District 22
Ft. Hood Environ	Roderick Chisholm	Director of Public Works – Ft. Hood
USACE	Jeff Tripe	Environmental Planner
USACE	Becky Griffith	Supervisory Regional Economist

AGENCY	NAME	TITLE
Regional Entities		
Brazos River Auth	John Baker	Middle and Lower Basin Manager
SWC District-Hamilton-Coryell	P M Gerald, Jr.	Chairman
SWC District – McClennan	Max Sturdivant	Chairman
SWC District – Bosque	J Charlie Blue	Chairman
SWC District – Central Texas	Stanley Glaser	Chairman
SWC District – Cross Timbers	Donald Smart	Chairman
SWC District – Upper Leon	Norman Moore	Chairman
Local Citizens		
Local Citizens	Truman Blum	BRA Board Member
Local Citizens	John Merrill	TX & SW Cattle Raisers Assn.
Dairy Farmers and Ranchers by Watershed		
Dairy Farmers of America	John Cowan	Legislative Environmental Manager
Farm Bureau – McLennan Co.	Jimmy Westerfeld	President
Farm Bureau – Bell County	Robert Fleming	President
Farm Bureau – Bosque County	Alan Day	President
Farm Bureau – Coryell County	Neil Walter	President
Farm Bureau – Hamilton County	Rusty Harris	President
Farm Bureau – Erath County	Paul Tyus	President
Farm Bureau – Comanche County	Tommy Elliott	President
Texas Farm Bureau	Darren Turley	Chairman, Dairy Advisory Committee
Cities by Watersheds		
Watershed – Leon River – Gatesville	Brandon Emmons	City Manager
Watershed – Leon River – Temple/Belton	David Blackburn	City Manager
Watershed – Bosque – Waco	Ricky Garrett	Director, Utility Services
Watershed – Bosque – Clifton	Jerry Golden	City Administrator
Watershed – Bosque – Clifton	Jim Burch	Director, Public Works
Watershed – Bosque – Clifton	Leon Smith	Mayor
Watershed – Bosque – Stephenville	Rusty Jergins	Mayor
Watershed – Bosque – Meridian	Marie Garland	Public Works Director
County Judges		
County Judge – Bosque	Cole Ward	Judge
County Judge – Erath	Tab Thompson	Judge

AGENCY	NAME	TITLE
County Judge – Coryell	John Hull	Judge
County Judge – Comanche	James Arthur	Judge
County Judge – McLennan	Jim Lewis	Judge
County Judge – Bell	Jon Burrows	Judge
County Judge – Hamilton	Fred Cox	Judge

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