

**A BARREL FULL OF HOLES:
A CASE STUDY OF
PENNSYLVANIA REGULATIONS ON
HIGH DENSITY LIVESTOCK FARM
POLLUTION**

Foreword

The fate of the efforts to clean up the Chesapeake Bay will be determined in large part on achieving significant reductions in the pollution that comes from agriculture. Pennsylvania has committed to ambitious, but necessary, reductions in the amount of nitrogen and phosphorus it contributes to the Chesapeake Bay – the Commonwealth must find some way to cut nitrogen pollution delivered to the Bay by at least 15.5 million pounds per year and phosphorus pollution must be cut by at least 150,000 pounds.

The lion's share of this pollution comes from agriculture, primarily from the nutrients – nitrogen and phosphorus - contained in animal manure disposed of on farm fields. A significant amount of the nutrient content of animal manure eventually runs off of farm fields and makes its way into local waterways and the Chesapeake Bay. The watersheds of the heavily agricultural lower Susquehanna River basin, including the Octoraro/Pequea/Conowingo Watershed (Watershed 7-K of the State Water Plan), are an intense source of nutrient pollution to the Bay.

The primary regulatory programs that attempt to control the amount of nutrients that end up in the water are the Nutrient Management Program and the Concentrated Animal Feeding Operation (CAFO) permitting system. Both of these programs fail to grapple with the fundamental problem of regulating nutrient pollution in heavily agricultural watersheds like Watershed 7-K – the sheer amount of animal waste that is being generated there. As the report will show, more than 2.8 million pounds of nitrogen is being generated by livestock in this watershed, and much of it is disposed of on fields in the watershed.

There is no provision in either the Nutrient Management Program or the CAFO permitting system that will limit the expansion of the livestock industry even in watersheds, like 7-K, that are already substantially overloaded with manure. As the livestock industry continues to put more and more animals in these areas, the failure to meet this challenge head on will ensure failure of efforts to reduce nutrient pollution of local waterways and the Chesapeake Bay.

As the report shows, the implementation of both of these programs only adds to the likelihood that they will be unable to bring about reductions in agricultural nutrient pollution from watersheds that are home to intensive livestock operations.

However, two new developments will help improve the situation:

- First, the Environmental Hearing Board recently ruled that nutrient management plans must now account for phosphorus. This ruling will help protect local water quality, but will also result in many acres of farm fields being ruled out for manure disposal exacerbating the manure disposal problem.

- Second, Governor Rendell signed a law that requires livestock operations that export manure to create nutrient balance sheets for fields where the manure will be spread, requires the records to be turned into the county conservation districts, and requires commercial manure haulers and brokers to be certified. If this law is fully implemented and strictly enforced, it will finally provide a complete picture of where, when, and how manure is disposed of. That information may finally expose the full extent of the manure disposal crisis in watersheds that host high animal densities. The response to that crisis will seal the fate of efforts to restore local water quality and the Chesapeake Bay clean up effort.

Pennsylvania's primary regulatory program to control pollution from agriculture, the Nutrient Management Program, is not achieving its goal of protecting and improving water quality, in the Octoraro/Conowingo/Pequea watersheds (Watershed 7-K of the State Water Plan). Nutrient Management Plans cannot achieve adequate control of agricultural pollution for three reasons: 1) the watershed is overloaded with manure; 2) the plans lack enforceable provisions that strictly control the disposal of animal waste, and; 3) there is a lack of adequate enforcement of the implementation of the plans. As a result, the program contains and controls nutrient pollution as well as a barrel full of holes contains water.

Citizens for Pennsylvania's Future (PennFuture) conducted a case study in Watershed 7-K (Pequea, Conowingo, Octoraro and Big Elk creek watersheds). This case study illustrates the impact of the failure of Pennsylvania's laws and regulations on the health, environment and economy of the region and beyond.

KEY FINDINGS

Pennsylvania's primary regulatory program to control pollution from agriculture, the Nutrient Management Program fails to protect water quality in the Octoraro/Conowingo/Pequea watersheds, Watershed 7-K of the State Water Plan. The key findings are listed below.

Implementation of Nutrient Management Plans

- Despite an intense effort by the Lancaster County Conservation District to bring livestock operators into compliance with their nutrient management plans, 59 percent of the operations are in violation of their plans.

The watershed is overloaded with manure and nutrients

- There are a total of 64 livestock operations that have nutrient management plans.
- 76,972,254 gallons of liquid manure are generated each year (enough to fill more than 3,800 railroad tanker cars).
- 58,624 tons of dry manure are generated each year (equal in weight to more than 27,000 Ford Explorers).
- Liquid manure storage capacity in the watersheds is 39,197,393 gallons.
- A total of 2,815,115 pounds of nitrogen from animal manure is generated in the watersheds each year.

Unaccounted-for manure and nitrogen

- 24,673,329 gallons of liquid manure (32 percent of the total liquid manure generated) and 14,060 tons of dry manure (23 percent of the total) is sent

off the farm to manure haulers or other farmers. This exported manure is not covered by any approved nutrient management plan.

- Almost 50 percent of the nitrogen, 1,403,326 pounds, is exported. The manure with the higher nitrogen content is far more likely to be exported than manure with lower nitrogen content.
- 89 percent of the livestock operations send some of their manure to manure brokers or other farmers.
- 45 percent of the livestock operators who export manure fail to keep records of the manure transfers.

Watersheds, stream segments and drinking water supplies are heavily impacted by nutrients.

- The Chester Water Authority's Octoraro Reservoir serves more than 200,000 people in the City of Chester and surrounding communities in Delaware County. Treatment plant operators frequently measure nitrate levels in the reservoir and in tributaries in excess of 10 mg/L, the drinking water standard for nitrates, and experience episodic incidents of manure runoff from frozen ground. Even after treatment, nitrates are still detectable in the finished water at levels ranging from 0.2 to 7.6 parts per million (ppm).
- 27 operations generating a total of 50,230,210 gallons of liquid manure and 21,190 tons of dry manure are located in high quality watersheds. 23 percent of the liquid manure and 21 percent of the dry manure is exported and not accounted for in any approved nutrient management plan.
- Half of the high quality watersheds in 7-K contain stream segments that are impaired by agricultural pollution.
- A total of 35 operations are sited in watersheds containing stream segments impaired by agricultural pollution. These operations generate 1,413,227 pounds of nitrogen; 42 percent or 601,269 pounds of nitrogen are exported and not accounted for in any approved nutrient management plans.

Introduction

Pennsylvania's primary program to control pollution from agriculture, the Nutrient Management Program, is not achieving its goal of protecting and improving water quality in Watershed 7-K. The plans cannot achieve adequate control of agricultural pollution for three reasons: 1) the watershed is overloaded with nutrients; 2) the plans lack enforceable provisions that strictly control the disposal of animal waste, and; 3) there is a lack of adequate enforcement of the implementation of the plans.

Agricultural pollution is one of the two primary causes of water quality degradation in Pennsylvania. Erosion of sediment into waterways and over-application of fertilizer to fields severely damages almost 3,000 miles of Pennsylvania streams.

Pennsylvania relies heavily on nutrient management plans to control agricultural non-point nitrogen pollution of lakes and waterways and regional water bodies like the Chesapeake Bay. In 1993, the Pennsylvania General Assembly passed the Nutrient Management Act. The goal of the Act was to reduce nutrient pollution to state streams and lakes and the Chesapeake Bay. It targets the storage and disposal of manure generated at livestock facilities, termed Concentrated Animal Operations (CAOs), which have an animal-to-land ratio of two animal equivalency units (AEUs) or more per acre. Later legislation required stricter permits for Concentrated Animal Feeding Operations (CAFOs), which are larger facilities with both the CAO-defined AEU density and more than 300 AEUs in total.

Manure contains the plant fertilizers nitrogen and phosphorus. When too much of either fertilizer enters waterways, it promotes the growth of algae and other aquatic plants. Algae blooms block sunlight from reaching beneficial aquatic plants, and when the algae die, their decomposition uses up available oxygen in the water making it unfit for aquatic life like fish.

The Nutrient Management Act requires regulated livestock operators to write and implement nutrient management plans that detail how manure will be stored and when and where it will be disposed of. The plans are supposed to ensure that the manure is spread in a time and manner that optimizes its fertilizer value for crops, prevent excess fertilizer from being applied to the land, and minimize the opportunity for the fertilizer to run off into waterways or leach into groundwater. However, the program does not necessarily prevent water pollution. Even if a facility pollutes the water, it cannot be held accountable if the pollution resulted from an activity conducted in accordance with the plan.

To evaluate the effectiveness of the nutrient management program, PennFuture conducted a review of the implementation of the nutrient management program in the Octoraro/Conowingo/Pequea watersheds in Lancaster and Chester

counties - Watershed 7-K of the State Water Plan. The review consisted of obtaining all of the nutrient management plans and CAFO permits approved in the watersheds and analyzing the information contained in them. The review uncovered a system wholly inadequate to ensure protection of water quality in watersheds overloaded with animals, manure and nutrients and completely unable to bring about reductions in pollution.

Our review of these plans has revealed that the effectiveness of the nutrient management program is severely compromised by four inherent flaws:

- There is an overload of animal waste and nutrients in the watershed;
- A significant portion of the manure and nitrogen generated in the watersheds is exported to fields not covered by approved nutrient management plans;
- Some of the provisions of the nutrient management plans are not enforceable;
- Even with a vigorous outreach and oversight effort, the plans' elements are not being fully implemented and a majority of operators are in violation of their plans.

Profile of Watershed 7-K

Watershed 7-K of the State Water Plan comprises the Pequea, Conowingo and Little Conowingo, Octoraro, and Big Elk creek watersheds. Agriculture is by far the predominant land use in these watersheds. About 85 percent of the land is in some kind of agricultural use. Watershed 7-K straddles the Chester-Lancaster county line and continues over the state border into Maryland. There are high quality streams in all of these watersheds, most notably the Conowingo, but many of the stream miles are degraded by agricultural pollution and officially listed as "impaired" by the Department of Environmental Protection (DEP)¹. There are also widespread high levels of nitrate/nitrite concentrations in groundwater².

Watershed 7-K also contains a public water supply reservoir, the Octoraro Reservoir, which serves 200,000 people in the City of Chester and surrounding communities in Delaware County. Water intake from the reservoir into the treatment plant is occasionally interrupted because of high nitrate levels coming from the tributaries to the reservoir, especially in the winter months when manure runs off frozen or snow-covered fields. At these times, the Chester Water Authority pulls water from the Susquehanna River to dilute the reservoir water in

¹ 303 (d) list of impaired waters

² Watersheds, An Integrated Water Resource Plan for Chester County, Pennsylvania and Its Watersheds, Chester County Comprehensive Plan, Sept. 17, 2002

order to meet drinking water standards for nitrates³. Treatment plant operators frequently measure nitrate levels in the reservoir and in tributaries in excess of 10 milligrams per liter, the drinking water standard for nitrates. Even after treatment, nitrates are still detectable in the finished water at levels ranging from 0.2 to 7.6 parts per million.⁴

The Nutrient Management Program in Watershed 7-K

Because the watershed straddles two counties, both the Chester and Lancaster County Conservation Districts administer the nutrient management program for livestock operations in Watershed 7-K. There are a total of 64 livestock operations that have nutrient management plans in the watershed – nine in Chester County and 55 in Lancaster County. Of these, 19 are large enough to be classified as CAFOs⁵ – four in Chester County and 15 in Lancaster County.

Manure and Nitrogen in the Watershed

The amount of manure and nitrogen generated in the watershed is so large that it poses significant disposal challenges. According to the nutrient management plans, 76,972,254 gallons of liquid swine and cow manure are generated in the watershed each year. In addition, chickens and dairy operations generate 58,624 tons of dry manure yearly. Combined, the liquid and dry manure contains 2,815,115 pounds of nitrogen.

Since nutrient management plans currently do not require balancing for phosphorus, there is no information in the nutrient management plans about the total amount of phosphorus generated or applied to land in the watershed. However, a very rough estimate obtained by adding up the animals reported in the nutrient management plans and calculating the amount of phosphorus contained in the manure using standard numbers contained in the Penn State Agronomy Guide suggest that about 1.6 million pounds of phosphorus are being generated in the watershed each year.

The aim of the nutrient management planning process is to ensure that the nutrients contained in the manure that is spread on crops is balanced against the needs of the crops that will grow there. This is supposed to ensure that the nutrients are taken up by the crops and will not find their way into the nearest stream or the groundwater. However, when a significant number of the livestock facilities in a particular area operate under contracts that require them to import feed rather than use crops grown locally, the connection between numbers of

³ Letter to DEP from the Chester Water Authority in reference to CAFO permit application for McMichael CAFO, August 25, 2000

⁴ Watersheds, An Integrated Water Resource Plan for Chester County, Pennsylvania and Its Watersheds, Chester County Comprehensive Plan, Sept. 17, 2002.

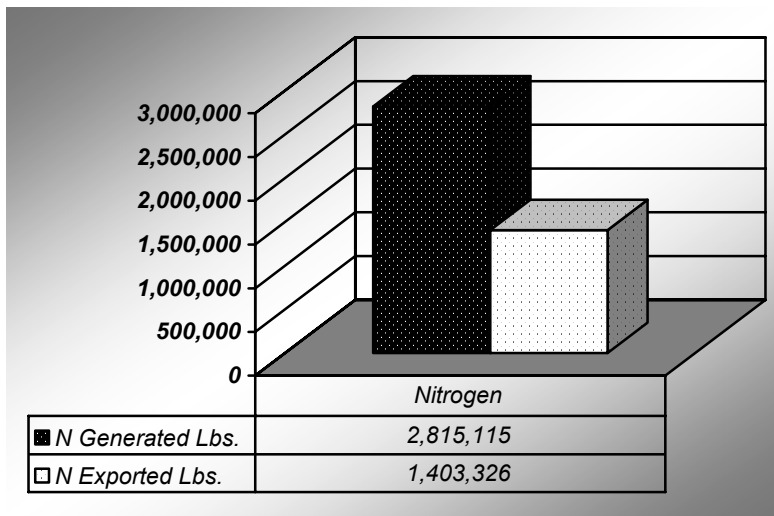
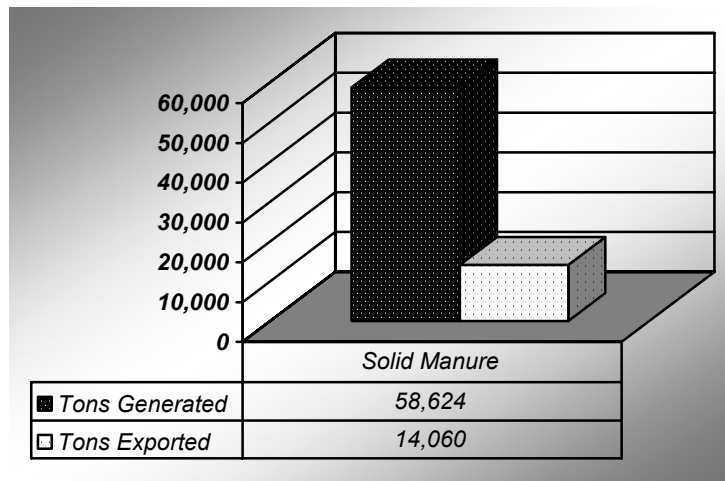
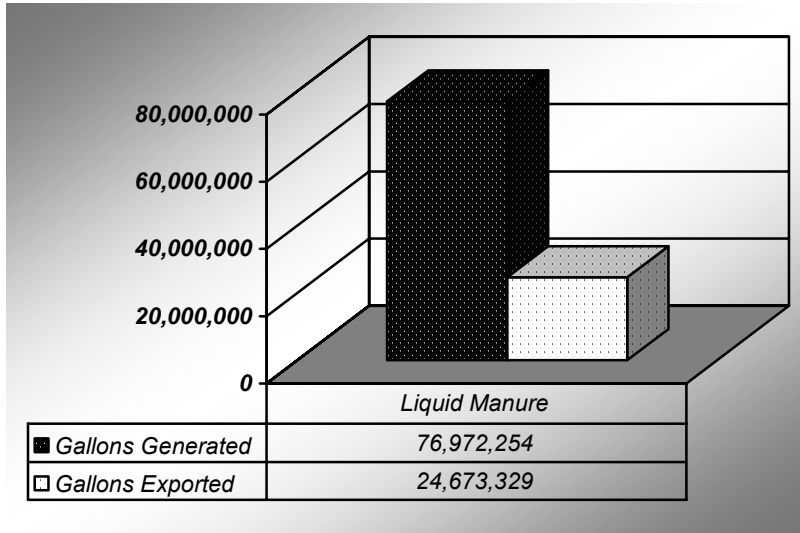
⁵ A CAFO is a livestock operation that meets the density threshold for Pennsylvania's Nutrient Management Program – 2 AEUs per acre – and also has at least 300 AEUs total or any operation with more than 1000 AEUs regardless of density or with a discharge to surface waters during a storm event at less than a 25 yr. 24 hr storm. Once an operation is that large, it is required to obtain a National Pollution Discharge Elimination System permit for CAFOs from DEP.

animals and cropland is broken⁶. In this circumstance, which exists in Watershed 7-K, more nutrients are imported into the watershed in the form of feed and ultimately processed by the animals into manure than can be used by the crops grown there.

To make matters worse, the regulations contain a major loophole that allows livestock operators to “export” the manure to other farmers – shipping it off the operation that generated it to fields not covered by an approved nutrient management plan. Fully 89 percent of the livestock operators in the watershed export some manure. Our review of the nutrient management plans shows that 35 percent of the liquid manure and 23 percent of the solid manure is being exported to fields not covered by approved nutrient management plans. In addition, the manure with the highest concentrations of nitrogen, swine and chicken manure, is more likely to be exported. As a result 50 percent of the nitrogen generated in the watershed is exported.

There is some transfer of this manure between watersheds, most of it bound for mushroom operations. However, only a few farms list the brokers that supply the mushroom operations in their nutrient management plans. A rough estimate based on that reporting suggests that about 20 percent of the nitrogen is transferred to mushroom growers. The pattern of manure transfers among neighbors and family members in these watersheds would indicate that most of the manure is transferred to nearby fields and remains in its home watershed.

⁶ A. E. Nord and L. E. Lanyon, “Managing Material Transfer and Nutrient Flow in an Agricultural Watershed,” Journal of Environmental Quality, March-April 2003.



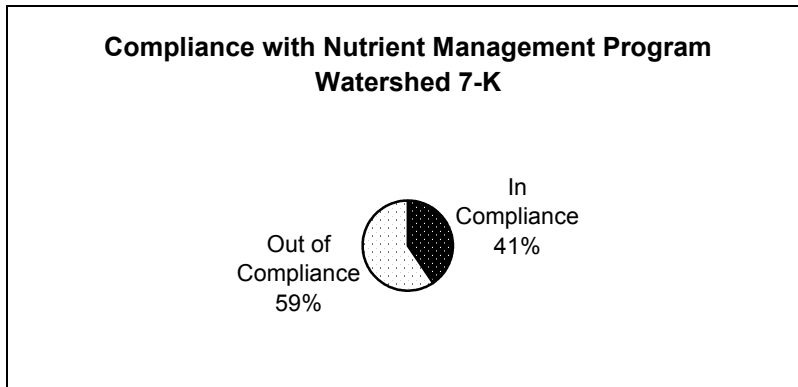
Implementation of the Nutrient Management Plans

County Conservation District staffs have no authority to enforce the Nutrient Management Program or cite the operators for being in violation of nutrient management plans. Operators in chronic violation of their plans must be referred to the State Conservation Commission, which has only three employees to handle enforcement for the entire state and has taken only ten enforcement actions over the history of administering the program. In addition, the Commission is under the purview of both the Department of Agriculture and the Department of Environmental Protection, with the Chair switching between the two. Consistent enforcement of regulations is nearly impossible under this bifurcated system.

The role of the conservation districts is to provide assistance to livestock operators in an effort to bring them into full compliance with the provisions of the nutrient management plans. Indeed, our review showed that there has been a significant effort on the part of the Lancaster County Conservation District to gain full implementation of the nutrient management plans. For instance, the conservation districts are charged with reviewing nutrient management plans every three years to evaluate the implementation of the plan and to inspect the operation to see if it has changed enough to warrant revisions to the plan. The Lancaster County Conservation District conducted timely reviews on all 46 of the nutrient management plans that reached the three-year deadline. In Chester County, conservation district staff had reviewed only three of nine operations, but all but two of them were due for their three year review.

However, despite the significant effort to ensure implementation of the nutrient management plans, 38 of the 64 operations reviewed — 59 percent — had not fully implemented their nutrient management plans, or had not kept important records that would allow the conservation district staff to determine that manure was being properly handled⁷. Of the operators that export manure, 46 percent of them were missing the manure transfer sheets that would at least identify the fields or manure brokers who had received their manure. Therefore, approximately 23 percent of the liquid manure and 32 percent of the dry manure was largely unaccounted for.

⁷ Our compliance figure is based on the compliance status in most recently available conservation district review.



Very often, manure disposal in this watershed is handled informally among neighbors and extended family networks. Many of the operators are members of plain sects, and record-keeping is not their forte. When records are available, they indicate that manure is frequently sent to farms not listed in the nutrient management plans. The notes in the review files indicate that conservation district staff provides ongoing assistance to livestock operators in an attempt to bring them into full compliance with their plans. As a result, many operations fall in and out of compliance during the course of the review cycle.

While record-keeping violations may seem trivial, the lack of complete records completely undermines the goals of the Nutrient Management Program – to ensure no more nutrients are put on fields than crops can use and to reduce nutrient pollution of local streams and larger water bodies like the Chesapeake Bay. The heart of the program consists of planning and management, and record-keeping is the primary regulatory requirement.

The only way conservation district staff and water quality managers at DEP can determine the real loading rates in the watersheds for nitrogen and phosphorus would be to have complete records of manure transfers and tabulate the data. In the absence of such a system, any estimates of nutrient loadings or projections of reductions are based on information so incomplete as to make them meaningless for use by water quality managers.

Concentrated Animal Feeding Operations in the Watershed

Of the 64 intensive livestock operations in Watershed 7-K, there are 19 facilities large enough to qualify as Concentrated Animal Feeding Operations (CAFOs). These are generally operations that have an animal-to-land ratio of more than 2 animal equivalency units (AEUs) per acre and more than 300 AEUs in total. Once a livestock operation reaches that threshold, it is required to obtain a CAFO water pollution control permit from DEP and, sometimes, a permit for its manure storage structure.

Of the 19 facilities that are large enough to qualify as a CAFO, six do not currently have CAFO permits. Of the six, one has a permit application pending and another has applied for a permit for its manure storage structure, and DEP

indicates that it is anticipating the permit application for that operation. Another was informed that it was required to apply for a permit, but DEP has not yet received the application. Two of the operations have a mix of poultry and dairy animals, and currently DEP does not require dairy operations with dairy herds under 300 AEU to apply for permits even when the poultry operation puts the entire operation over the 300 AEU threshold.

The CAFOs generate almost 85 percent of the total manure and 60 percent of the nitrogen in the watershed — more than 65 million gallons of liquid manure and more than 34,000 tons of solid manure containing more than 1.6 million pounds of nitrogen. About 36 percent of the nitrogen is exported to fields not covered by an approved nutrient management plan. Five of these operations raise only hogs, four of them are dairies, and ten of them have a mix of hogs, poultry and cattle.

There were no records of any inspections by the conservation districts or DEP for three of these facilities. Of the 16 facilities inspected, 11 were in violation of either their CAFO permit or their nutrient management plans and five were in full compliance.

Impaired Watersheds

Half of the livestock facilities in this review are located in watersheds where the entire streams or significant stream segments do not meet water quality standards because of agricultural runoff and nutrient pollution. These 32 facilities generate a total of almost 43 million gallons of liquid manure and more than 20,000 tons of dry manure. This manure contains 1.25 million pounds of nitrogen. About a quarter of the manure is exported, but since the manure with the highest concentration of nitrogen is more likely to be exported, 44 percent of the nitrogen in the impaired watersheds is being exported to fields not covered by an approved nutrient management plan.

Currently, DEP does not consider the cumulative impact of the amount of manure and nitrogen being generated in the watershed when evaluating applications for new or expanding facilities large enough to be CAFOs. CAFO permits are “non-discharge” permits, so no discharge of manure from manure storage structures is allowed except during very large rain storms. The increased pollution from the inevitable polluted farm field runoff is not considered, nor is the potential for manure exported to fields not covered by an approved nutrient management plans taken into account. As a result, DEP does not attempt to limit manure generation or land application in impaired watersheds.

Special Protection Watersheds

There are 27 livestock facilities, or 42 percent of the operations, located in high quality watersheds. These facilities generate more than 50 million gallons of liquid manure and more than 21,000 tons of dry manure. This manure contains

about 1.5 million pounds of nitrogen and about 34 percent of that is exported. Unfortunately 14 of the high quality streams also contain segments impaired by agricultural runoff. Right now, DEP does not take the potential for a CAFO to degrade water quality or to make it harder to clean up existing water quality problems into account when considering permit applications. Usually, facilities applying for water pollution control permits in high quality watersheds must demonstrate that their activities will not degrade the streams. DEP does not require this demonstration for CAFO applications, however, apparently based on the “no discharge” requirement. But as mentioned above, preventing discharges from the storage structures does not prevent nutrients from running off fields and into high quality streams after the manure is spread and causing serious water pollution problems.

Winter Spreading

The spreading of manure onto frozen or snow-covered fields is discouraged, but not prohibited in the nutrient management program. Manure spread onto frozen or snow-covered fields is merely being disposed of since there are no plants growing to take up the nutrients and it is highly likely to wash into the nearest stream with a quick melt or rainfall. The practice is routine and widespread and poses significant threats to water quality. During the winter, the Chester County Water Authority frequently must pump in water from the Susquehanna River to dilute the Octoraro reservoir water in order to reduce the nitrate levels sufficiently to meet drinking water standards.⁸

⁸ Letter to DEP from the Chester Water Authority in reference to CAFO permit application for McMichael CAFO, August 25, 2000

Recommendations

IMPLEMENTATION

- A nutrient management program enforcement officer should be placed at each conservation district (or, in areas with few CAOs one enforcement officer could handle several conservation districts in a region) whose sole responsibility would be to inspect CAOs and CAFOs for compliance with their plans and permits.
- Chronic violators should be referred to the State Conservation Commission.
- Oversight and funding of the State Conservation Commission should be solely under the Department of Environmental Protection.
- Chronic violators should be barred from receiving federal or state funding for technical assistance or purchase of equipment.
- Nutrient management plans should contain enforceable provisions.
- The plans should also address the phosphorous content of manure spread on all fields.

TRACKING MANURE GENERATION AND DISPOSAL

- Exporters should be required to create balance sheets for both nitrogen *and* phosphorous for manure sent to other farmers' fields.
- Conservation districts should use the nutrient management review process to collect data about the amount of manure generated and its nutrient content and submit it to DEP.
- Livestock operators should be required to submit all manure transfer sheets to conservation districts each year. These should be considered public documents.
- Conservation districts should be required to tabulate all manure transfer data and submit it to DEP each year so that water quality managers can use the information for program implementation including the development and implementation of Total Maximum Daily Load (TMDL) and Chesapeake Bay Program Tributary Strategies.

REQUIREMENT TO OBTAIN A CAFO PERMIT

- Pennsylvania's should add the language of the U.S. Environmental Protection Agency (EPA) requiring all facilities that contain certain numbers of animals to obtain CAFO National Pollution Discharge Elimination System (NPDES) permits in addition to its density thresholds that currently trigger the requirement to get a permit.
- DEP should require all livestock facilities that meet the regulatory definition of a CAFO to obtain a permit.
- DEP should consider cumulative impact, impaired watersheds, TMDLs and limestone geology when determining that a livestock operation needs a CAFO NPDES permit.

- Any facility that has created a discharge should be required to obtain a CAFO NPDES permit.

REVISIONS TO CURRENT POLICY

- Require NPDES CAFO applicants in high quality watersheds to satisfy all antidegradation program requirements.
- Spreading on frozen or snow covered ground should be prohibited.
- In watersheds where a TMDL and a nutrient reduction program have been established, no additional manure should be allowed to be applied to land unless it is expressly accounted for in the TMDL. Thus, if a farming operation intends to expand (or establish itself) it would have to develop an alternative manure utilization plan. The Administration should place a temporary moratorium on CAFO expansions in watersheds that are impaired for nutrients and no TMDL has yet been developed.