NITRATE CONTAMINATION OF GROUNDWATER FROM FERTILIZER: A Review of State Programs.

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Note: This review was prepared for the "Nitrogen as a Case Study" session of the University of California, Pomology Extension Continuum Conference, Modesto CA, March 1992. This paper assumes the reader is aware and familiar with the nitrate in groundwater situation in California. A number of references are included to provide additional information on the subject. Some material appearing below comes directly from the listed references. There is considerable debate about the most effective approaches to address this very pervasive problem. The purpose of the paper is to provide some perspective to a discussion that we hope will lead to a consensus on the most realistic and effective strategy to address this situation. Our premise is that unless this situation is dealt with by the agricultural community the government will eventually step in and impose restrictions on the use of fertilizers.

Introduction

Several countries and states have recognized the warning signs of studies showing elevated levels of nitrate in public and private drinking water wells and are taking steps to halt further contamination.

While farming practices are not the only source of contamination, most of the state nitrate management programs and strategies focus on agriculture. Some rely on voluntary efforts by farmers to alter their fertilizer handling and application practices. Others use tougher, mandatory means.

A number of states have programs for controlling agricultural sources of nitrate contamination. Many also include a component on protection from pesticide contamination. This review will only address nitrate. Although the efforts differ in their specifics, all grew out of a common, growing concern about the threat to ground water posed by extensive use of nitrogen fertilizers and concentrated animal feeding operations. Programs dealing with nitrate groundwater contamination can be broadly grouped as follows:

1- Established programs with a strong regulatory component such as the case of Arizona, Nebraska, Germany and the Netherlands,

2- Established programs with a strong voluntary research and demonstration component such as the case of Iowa, and

3- Fledgling programs with a voluntary research and demonstration component that may also have regulatory provisions such as Wisconsin, Minnesota, South Dakota and California.

This paper will review all the above mentioned groundwater protection programs except for the two European programs and the California program (see references).

Arizona

With mandatory, enforceable best management practices for agricultural producers as its centerpiece, Arizona's nitrate control program is among the toughest in the nation. The Arizona Regulated Agricultural Activities Program was established in 1986 to control nitrate pollution from agricultural sources. It is run by the Arizona Department of Environmental Quality.

Under the program, all farmers using fertilizers or those having a concentrated animal feeding operation are automatically issued a general permit requiring compliance with best management practices in order to meet water quality objectives.

Development with input from the agriculture community, the best management practices rules constitute general goals that apply state-wide; accompanying them are a list of alternative technologies that farmers may choose from, depending on site-specific conditions, to meet overall goals.

Among the Best Management Practices for the application of nitrogen fertilizer are rules that application shall be limited to the amount necessary to meet projected crop plant needs, and that application shall be timed to coincide as closely as possible with periods of maximum crop plant uptake.

Best management practices for animal feeding operations include the requirement that animal manure be collected, stockpiled, and disposed of as economically as feasible to minimize discharge of nitrogen pollutants by leaching and runoff.

An enforcement component puts teeth into the Arizona program. When an inspector from the Department of Environmental Quality finds evidence that a facility is violating best management practices, he or she issues a letter of warning giving the facility operator thirty days to come into compliance. If the operator fails to comply, the general permit is revoked. To stay in business, the farmer must go through the lengthy and costly process of obtaining an individual permit.

In applying for the individual permit, the farmer must show how the farm operations will be conducted so as to meet the state's aquifer water quality standards. Strict requirements for protecting groundwater may be written into the individual permit. Severe monetary penalties may be imposed on a farmer who fails to satisfy the requirements of the individual permit.

According to a department staff member, general permits were issued to all farmers in January 1991. So far, the department has issued one letter of warning - in this case, to a concentrated animal feeding operation.

Nebraska

Like Arizona's, Nebraska program makes use of mandatory groundwater protection measures. However, it allows for more local input in the drafting and implementation of those controls. It also includes a mechanism for localities to finance the implementation of the groundwater protection measures.

Under the state's Special Protection Area Program, created in 1986, any state agency or political subdivision can apply to the Department of Environmental Control for a special protection area designation when it suspects nonpoint source groundwater contamination exists or will soon occur.

Before the designation can be made, the department must conduct a detailed study to confirm that the groundwater contamination is being caused by nonpoint sources. It must also hold a public hearing to receive comments on the potential designation.

Once a special protection area is designated, the local natural resource district or districts covering the area must develop an action plan to prevent further groundwater contamination.

The action plan must include a program to educate people about the problem and ways to reduce contamination. It also must include a requirement that water users participate in the educational program, and/or that certain best management practices be followed.

Plans must be submitted to the department for approval if a natural resource districts fails to develop an acceptable action plan, the department is authorized to do the job itself.

Action plans approved by the department are implemented by the natural resource district. The districts have the power to levy an additional property tax of two cents on each one hundred dollars of assessed value to implement the plan.

Finally, the natural resource district is required to establish a ground-water sampling program within the special protection area. Results are used to monitor nonpoint source contamination, and evaluate the effectiveness of the action plan in controlling, stabilizing, and preventing the pollution.

Although the program covers all types of contamination, it was intended primarily to address nitrates - the state's most prevalent groundwater pollutant - according to a paper by Gale Hutton, chief of the water quality division in the Nebraska Department of Environmental Control.

So far, eight special protection area studies have been undertaken. The department designated its first special protection area in February 1990, and is currently in the process of designating a second area, according to program manager Dick Ehrman.

Iowa

Contrary to the Arizona tactic, Iowa has undertaken an ambitious comprehensive research and demonstration program to protect water quality. While these programs have been in place for approximately 10 years, it has only been vigorously pursued since 1987 when the Iowa Groundwater Protection Act was established. Since then various types of farm management programs have touched nearly every Iowa county.

Among these programs are the Integrated Farm Management Demonstration Program, the Model Farms Demonstration Project and the Pesticide Applicator Training Program.

The purpose of the programs is to reduce groundwater and surface water contamination by showing farmers improved ways to use nitrogen, other crop nutrients, pesticides and animal manures. The demonstration projects include a wide variety of topics including nitrogen fertilization, weed management, spoke injected nitrogen, conservation tillage alternatives, and manure management among others. Demonstrations are located on farmers' fields, and the farmers are provided with individual help in refining their practices. Finally information links are established with other farmers.

These programs have had an impact. Data from the National Agricultural Statistics Service show that nitrogen use has dropped significantly compared to other Corn Belt states. Within Iowa, nitrogen use has dropped from a high of 150 lbs/acre in 1985 to 126 lbs/acre in 1989 and 1990. These changes appear small but translate to approximately $40 million and a 270 million pound reduction in nitrate loading on Iowa's 11-13 million acres of corn. Other benefits include a reduction in diesel fuel.

One component of the program is the Big Spring Basin Demonstration Program. Farmers in that region reduced nitrogen fertilizer applications by 21 percent from 1981 to 1989 - an annual savings of $200,000. George Hallberg, an environmental geologist at the Iowa Department of Natural Resources expects the cuts to be reflected in lower rates of nitrates in the area's groundwater.

But this is not the only geographical area that benefited. Butler County farmers saved about $500,000 in 1989 by reducing fertilizer and pesticide applications through improved farm management.

Program personnel believe that the outreach component was vital to the initial success of the program. Field days, public meetings and intensive marketing and information efforts were all used as means to increase farmers awareness about nitrogen use and water quality.

Funding for these programs came from federal oil overcharge funds which are due to expire in 1992. However, staff believe there is still work to be done. They hope to continue these efforts and establish new programs with agricultural chemical dealers. "Instead of posing a threat to their businesses, nitrogen management programs are a way for dealers to reach clients by offering soil testing and comprehensive crop management services", said Jerry DeWitt of ISU Extension.

Along with Iowa State University Extension, the Iowa Department of Agriculture and Land Stewardship and the Iowa Department of Natural Resources are spearheading the program. Others involved are the U.S. Department of Agriculture Soil Conservation Service, ISU's Leopold Center for Sustainable Agriculture, ISU's Agricultural and Home Economics Experiment Station and the Iowa Fertilizer and Chemical Association.

Wisconsin

Wisconsin is also taking a voluntary approach to groundwater quality protection, but their program is less vigorous than Iowa's. In July of 1986, the Department of Agriculture, Trade and Consumer Protection (DATCP) established a committee to investigate the regulation of pesticides and nitrates, and investigate the desirability of regulating nitrate use and possible methods of regulation, among other topics.

The committee found the study of nitrates to be complex. Nitrate is the most common chemical contaminant found in Wisconsin groundwater. This committee advised that it was not currently practical to regulate the use of nitrogen fertilizer, but felt that it was indeed a serious problem that merited attention. The committee then recommended that (1) a task force be established to recommend regional level Best Management Practices to increase the efficiency of applied nitrogen, (2) target populations be educated on the health effects which may result from consuming water contaminated with nitrate, (3) eligibility for well compensation be extended to small businesses serving drinking water to the public, and (4) the toxicity of nitrate be evaluated further.

Minnesota

Minnesota adopted groundwater legislation in 1989. Their approach is primarily voluntary, yet the law includes some provisions for regulation. Efforts to reduce nitrate contamination from agricultural sources rest with the Department of Agriculture's Office. Under the legislation, the Commissioner of Agriculture has developed and is promoting the implementation of Best Management Practices on a regional basis. If the BMP's are ineffective, the Commissioner must then adopt water resource protection requirements. The Commissioner of Agriculture in conjunction with the Minnesota Extension Service and the crop consulting community has also developed a voluntary crop consultant certification program for soil analysis laboratories.

The Best Management Practices for nitrogen fertilizer are based upon a 3 tier strategy including state-wide, regional and special situation BMP's. Each succeeding tier enhances or refines the previous tier. State-wide areas apply to all areas of the state, while regional BMP's account for some of the local variation in soils, hydrogeological and climatic conditions. 5 regional areas have been classified. Special situation BMP's have been named for additional susceptibility problems. These describe management criteria for irrigated soils, course-textured non-irrigated soils, turf and areas near surface water.

South Dakota

In January of 1989, South Dakota's enacted the South Dakota Centennial Protection Act which calls for a broad strategy in protecting its groundwater. This legislation covers many aspects related to groundwater contamination including regulation of water rights; use, storage and handling of pesticides and fertilizers; regulation of chemigation, hazardous wastes, and PCB's as well as other areas.

The agricultural component of this legislation provides for a landmark 5 year groundwater research and education program to be cooperatively undertaken by the Department of Agriculture and the Department of Environment and Natural Resources (DENR). This study will provide groundwater management information, an identification and assessment of the environmental and the socioeconomic impacts of agricultural practices. They also propose to develop alternative agricultural practices for the long-term health and maintenance of South Dakota's agriculture.

Funding for the groundwater protection fund comes from fees on pesticide registration, inspection fees for all commercial fertilizers delivered in the state, and a yearly fee of $.02 per pound of cyanide or other chemical leaching agent used to mill ore from surface mining operations. Supplemental funding comes from the state's petroleum release compensation fund.

Previous to the 1989 legislation, DENR initiated a pilot pesticide and nitrogen sampling program to assess the presence of agricultural chemicals in the groundwater. Testing was concentrated in areas of intensive farming where groundwater levels were shallow, and where permeable outwash existed. Results of the testing show that surface activities may be a major source of contamination.

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