AGRICULTURE: ENVIRONMENTAL PROBLEMS AND DIRECTIONS

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Review of Iowa's water quality situation has both "good news" and "bad news" components. The "good news" is that since passage of the 1972 federal Clean Water Act, commendable progress has been made in reducing the discharge of municipal and industrial waste pollutants into Iowa's waters. The progress made in reducing pollution from these point sources is attributable to a number of factors, including the enactment of effective laws and regulations, development and implementation of improved waste management practices, and voluntary and enforced compliance.

The "bad news" in Iowa's water quality picture is that, as progress is made in controlling point source pollution, it has become very evident that pollution from nonpoint sources is having major impacts on the quality of Iowa's surface and ground waters.

Recent assessments by the Iowa Department of Natural Resources (DNR) have shown that nonpoint pollution, from both agricultural and non-agricultural sources, is making it difficult for many of Iowa's lakes and streams to support fish and other aquatic life, recreational uses such as fishing and swimming, and as the source of water for public water supplies.

At the same time, research and monitoring in the 1980's has shown that Iowa's ground waters are being contaminated by a variety of pollutants, including agricultural and industrial chemicals, nitrates, bacteria, and petroleum products. Although a portion of this pollution may be the result of natural processes, most is attributable to human activities, such as: storage, mixing, and application of agricultural chemicals; transport, storage, and disposal of industrial chemicals; landfilling and land disposal of wastes; leaking lagoons, septic tanks, and underground storage tanks; and, poor well construction or maintenance.

In my remarks, I will attempt to cover three major issues. These include:

* How is pollution from agricultural sources impacting Iowa's surface and ground waters?
* What actions have the state and federal governments taken to address such pollution?
* What may we expect in the future as far as governmental actions directed at agricultural sources of pollution?

What are the problems? The first question I want to address is "What impact is pollution from agricultural sources having on Iowa's surface and ground waters.

A recent DNR study clearly identifies agriculture as a major pollution source for Iowa's surface waters. This study, the 1990 Iowa 305(b) Water Quality Assessment (IDNR 1990), found that out of 7,155 stream miles assessed, less than 1% were fully supporting their designated water uses. The other 99% of Iowa's streams were being impacted to such a degree that designated water uses were either only partially or were not supported. Designated uses included supporting fish and other aquatic life; recreational activities such as swimming, boating, and fishing; and use as a water source for public water supplies. Agriculture was identified as the primary pollution source impacting these streams, with over 96% of the stream miles impacted by agriculture. (No other pollution source was found to impact more than 4% of Iowa's streams.)

The same study found a somewhat similar, although less dramatic, situation for lakes. Out of 114 lakes classified by DNR as "significant publicly owned lakes", 83 were found to be only partially supporting or not supporting their designated water uses. For 74 of these lakes, agriculture was identified as the primary pollution source.

For Iowa's streams and lakes, the pollutant causing the greatest water quality impacts is sediment. The 1990 DNR study identified sediment as being the major pollutant for 93% of Iowa's stream miles, as well as for 68 of the 83 lakes which did not fully support designated water uses.

Sediment can impact surface waters in a variety of ways, including: clogs stream channels and interferes with drainage; covers fish spawning and feeding areas and makes it difficult for sight feeding fish to find food; reduces aesthetic value of recreation areas; increases treatment costs for water supplies; reduces water volume of lakes and reservoirs; and carries nutrients and pesticides into lakes and streams.

The severity of Iowa's sediment related water quality problems can be illustrated by citing several examples. A 1986 report by USDA's Soil Conservation Service estimated that sediment annually caused $10 million in damages to Iowa's recreation, fish and wildlife resources, with an additional $1 million in damages done to municipal water supplies.

The severity of sediment impacts on an individual water body can be illustrated by looking at Lake Red Rock. During the nine-year period from 1969 to 1977, average sediment movement into the lake was 16,500 tons per day, and over this period 29% of the lake's conservation pool was filled with sediment.

Excessive erosion of Iowa's croplands is the major cause of the sediment entering Iowa's lakes and streams. Such erosion is the result of a number of factors, including: conversion of highly erodible lands to row crops; failure to include cover crops in crop rotations; use of clean tillage practices; and failure to utilize other management and structural erosion control practices where needed.

Although sediment is a major pollutant of Iowa's surface waters, it is not generally a problem in ground waters. However, in instances where there is a direct conduit between surface and ground waters (such as in areas of northeast and north central Iowa with sinkholes or agricultural drainage wells), sediment can move to ground waters. An example of this occurred earlier this year in the Big Spring Basin area of Clayton County, when heavy rainfall runoff carried high quantities of sediment into sinkholes. This sediment was later discharged at the Big Spring Trout Hatchery, which serves as the outlet of the Big Spring Basin, and covered the bottom of the fish growing raceways with 2 to 3 inches of silt.

Nutrients, particularly nitrogen and phosphorus, as a second category of agricultural pollution impacting Iowa's surface and ground waters. Although on a statewide basis nutrients rank below sediment as a pollutant of Iowa's surface waters, for certain waters nutrients may cause the greatest water quality impacts. For ground waters, high nitrate concentrations are a major concern.

Problems associated with high nutrient levels in surface waters include: excessive growth of algae and other aquatic plants may interfere with swimming, boating, and other recreation and water supply uses; die-off of algae and other plants may cause taste and odor problems for water supplies; and decomposing plants may reduce dissolved oxygen levels and result in fish kills. High nitrate concentrations in drinking waters are potentially toxic to infants, since methomoglobinemia (blue baby syndrome) may result. In addition, several studies have implicated high nitrate concentrations with other health concerns, including increased cancer rates and birth defects.

DNR's 1990 Water Quality Assessment identified nutrients as the major pollutant for only 1% of the stream miles assessed as partially or not supporting designated uses, but listed nutrients as a secondary pollutant for 98% of these miles. For significant publicly-owned lakes, nutrients were identified as the major pollutant for 17 lakes, and as a secondary pollutant for 64 lakes.

High nitrate levels are periodically a problem for Iowa municipalities which depend upon surface waters as the source of their public water supply. This was perhaps best demonstrated by the number of newspaper articles which appeared in the Des Moines Register last spring regarding the difficulties the Des Moines

Water Works was having in dealing with high nitrate levels in the Des Moines and Raccoon Rivers.

Because phosphorus is only slightly water soluble, it generally enters Iowa's surface waters attached to eroding soil particles. However, since nitrogen is highly soluble, it enters both attached to soil and dissolved in runoff waters. In its nitrate form, nitrogen may enter surface waters in runoff waters, in tile drainage, or as subsurface drainage. In addition, nitrate may leach into deeper ground water aquifers.

Of water samples analyzed by the University Hygienic Laboratory from private water wells for the period from 1980-87 (SCS 1989), over 30% of the samples submitted from 27 Iowa counties exceeded EPA's drinking water standard of 45 parts per million (as NO3). These 27 counties were generally located in western and southern Iowa, where shallow wells predominate. Since many of these samples may have been submitted in response to suspected problems with the water supply, the results may not be representative of the nitrate problem statewide.

A Statewide Rural Water Well Survey (SWRL) study was conducted in 1988 and 1989. This study was designed to be representative of statewide conditions, and systematically selected and sampled 686 private rural wells across Iowa. The SWRL findings (Hallberg and Kross 1990) indicated about 18% of rural private drinking water wells in Iowa have nitrate levels above the EPA drinking water standard. Again, contamination was greatest in western and southern Iowa. Regional variation in percent of wells exceeding the nitrate standard ranged from 38% in northwestern Iowa to 5.6% in north central Iowa.

Agricultural practices which contribute to nutrient-related water quality problems include: excessive soil erosion; use of fertilizers in excess of crop needs; failure to account for nutrient contributions of legumes and animal manures; and failure to coordinate timing of fertilizer applications according to crop needs.

Pesticides are a third category of agricultural pollutants impacting Iowa's surface and ground waters. Pesticides may enter surface waters attached to eroding soil particles, dissolved in surface runoff, in tile drainage, or by movement from soil-water or ground water into surface water. Pesticide movement into ground waters generally occurs via leaching through soil and subsoil layers but pesticides may be conducted directly to ground water through agricultural drainage wells or sinkholes.

Problems associated with pesticides in surface waters include: pesticides may cause behavioral or reproductive changes in aquatic organisms; some pesticides concentrate in plant and animal tissues and are subsequently ingested by animals and humans; and, high

levels of pesticides may cause fish kills. Because health effects of long-term ingestion of low concentrations of pesticides are difficult to study and consequently are generally unknown or poorly understood, pesticides in surface or ground waters used as a water supply are cause for concern.

A number of recent studies show that pesticides are being detected in surface and ground waters of the state with significant frequency and sometimes at concentrations exceeding health advisory levels.

Monitoring conducted by the U.S. Geological Survey in 1989 (Hallberg 1990) of 150 streams in 10 midwest and north central states showed that even prior to application of herbicides in March-April, 89% of the samples had pesticide residues. None of the pre-application samples exceeded EPA-established health advisory levels. However, 98% of May-June samples (taken after application) had pesticide residues; 55% exceeded the maximum contaminant level (MCL is 3 ug/L) for atrazine, and 34% exceeded the MCL (2 ug/L) for alachlor.

A 1986 study (Wnuk et.al. 1987) conducted by the DNR and the University of Iowa Hygienic Laboratory furnishes evidence that pesticides in drinking water from public water supplies using surface water sources are cause for concern. Samples of treated (finished) drinking water were collected in May through early July from 33 public water supplies using surface water sources. Atrazine, cyanazine, metolachlor, and alachlor were detected in samples from 30, 26, 21, and 17 of the water supplies respectively. Atrazine was present at concentrations exceeding the health advisory level (3.0 ug/L) in samples from 10 of the water supplies and cyanazine exceeded the health advisory level (10 ug/L) in samples from 2 water supplies. Alachlor exceeded the maximum contaminant level (2 ug/L) in samples from 2 supplies.

Iowa State-Wide Rural Well Water Survey results (Hallberg and Kross 1990) indicate that about 13% of the private, rural drinking water wells in Iowa are contaminated with one or more pesticides and about one percent of these wells are contaminated with a pesticide exceeding recommended or established lifetime health advisory levels. Atrazine exceeded health advisory levels at five sites, alachlor at two sites, and trifluralin at one site.

Iowa's problem of pesticides reaching water resources is widespread and can only be addressed with widespread adoption of pest and pesticide management practices that incorporate water protection considerations. Water-protecting pest management practices Iowans should emphasize include: application of "integrated pest management" (IPM) principles to a specific situation, particularly economic justification of pesticide use; use of alternatives to pesticides when possible; limiting area coverage or rates of pesticides; post-emergence use of pesticides

(after need and economic feasibility are determined); choice of the pesticide alternative that poses the least threat to water; and, careful and accurate handling, mixing, application, and container disposal to reflect local water protection needs.

What is currently being done to address the problem? The second question I want to address is "What actions have the state and federal governments taken to address agricultural nonpoint pollution?".

In response to public concerns, in recent years both the state and federal government have begun to address these problems. In most instances, governmental actions have emphasized research and development of farming practices that have less water quality impact, coupled with public information programs, demonstration projects, and technical and financial assistance programs to encourage voluntary actions by individual farmers. In a few instances, actions have been of a regulatory or quasi-regulatory nature.

Iowa has actively begun to address pollution from agricultural sources, with perhaps the most widely recognized action being the adoption in 1987 of a comprehensive state Groundwater Protection Act. This Act included funding for several new programs designed to inform and educate farmers on the use of improved fertilizer and pesticide management practices. Funding of $7.5 million was provided to carry out a five-year statewide Integrated Farm Management Demonstration Project, $200,000 went to sinkhole and agricultural drainage well demonstration programs, and $100,000 was provided for a targeted education program dealing with controlling ground water contamination from agricultural drainage wells, abandoned wells, and sinkholes.

In addition, the Groundwater Protection Act provided $310,000 to continue the Big Spring Basin Demonstration Project. This project, located in Clayton County in Northeast Iowa, is studying how farming practices within the basin's watershed affects the area's ground waters. A unique feature of this basin, and one that makes it particularly suitable for study, is that most of the area's ground waters exit the basin at the Big Spring trout hatchery, where water quality can be monitored. Similar to the other programs, a focus of the Big Spring Project is on demonstrating and encouraging the use of farming practices compatible with water quality goals.

In 1988, as part of the state REAP Act, the Iowa Legislature established a state Water Protection Fund. This fund offers financial incentives to participating farmers within designated priority project areas and statewide for implementation of a variety of erosion control, chemical management, and animal waste management practices.

More recently, Iowa has established a Model Farms Demonstration Project, involving implementation and demonstration of improved farm management practices on clusters of cooperating farms in five areas of Iowa. Practices emphasized in individual projects will include conservation tillage, integrated farm management, agricultural drainage well control, and forage and woodland production.

Earlier this year, the Department of Natural Resources received about $850,000 in EPA Section 319 funds to carry out a number of nonpoint pollution control projects. Projects funded under this program include expanded nonpoint related public information and education activities, animal waste management, demonstration of specific farm management practices, and several lake and ground water protection projects.

All of the above programs are designed to develop and demonstrate the use of farming practices which maintain farm profitability while reducing adverse environmental impacts. In addition, all of these programs utilize public information and education activities as tools to encourage use of such farming practices, and most provide technical assistance and financial incentives to further encourage farmers to adopt such practices.

While the state is clearly emphasizing a voluntary approach to dealing with water pollution from agriculture, several regulatory actions have also been taken. These include revision of the pesticide certification program (as part of the 1987 Groundwater Protection Act), adoption of secondary containment requirements for many fertilizer and pesticide storage and handling sites, and adoption of rules restricting the use of atrazine in certain areas of the state.

The Groundwater Protection Act made several changes in Iowa's pesticide certification program, including requiring anyone applying restricted use pesticides to be certified and requiring that a state exam be taken in order to become a certified applicator.

In response to recommendations from the Iowa Fertilizer and Chemical Dealer's Association, in 1986 the Department of Agriculture and Land Stewardship adopted rules requiring construction of secondary containment facilities at most commercial fertilizer and pesticide storage, loading, and mixing sites.

Most recently, the Department of Agriculture and Land Stewardship adopted rules which restrict the maximum application rate for atrazine statewide to 3 pounds per acre, and limit application to 1.5 pounds per acre in designated areas where ground waters are particularly vulnerable to contamination. In addition, the rules limit application near water sources, such as sinkholes, wells, cisterns, and lakes and ponds.

Federal agencies are also becoming more active in addressing environmental issues. In Iowa, this is perhaps most evident by considering the actions being taken in implementing the "Conservation Reserve Program", the "conservation compliance", and the "swampbuster" and "sodbuster" provisions of the 1985 Farm Bill. As a result of these provisions (particularly the entry of about 2 million acres into the Conservation Reserve Program), substantial reductions in soil erosion in Iowa have already been achieved, and further reductions should occur as farmers make progress in implementing their compliance plans. Since cropland soil erosion is the major source of sediment in Iowa's lakes and streams, the reductions in soil erosion also translate to improved water quality.

These 1985 Farm Bill programs can perhaps best be considered as quasi-regulatory, since although they do not mandate farmer compliance, failure to comply carries with it the threat of being ineligible to participate in any federal farm programs.

In recent years, the US Environmental Protection Agency has increased its activities related to control of nonpoint source pollution. Some of this increase is the result of having to administer new nonpoint planning and implementation requirements of the 1987 Clean Water Act. However, other factors, such as studies identifying nonpoint pollution as a major source of ground water contamination, have also caused EPA to place higher priority on control of nonpoint pollution. At present, EPA's activities have been directed mainly at obtaining additional research and monitoring information, and on identifying alternative approached for dealing with various nonpoint problems. Except for tightening its requirements for registration of pesticides and recent adoption of rules dealing with control of stormwater runoff from urban and industrial areas, EPA's actions have generally been non-regulatory.

Other federal agencies are also becoming more active in water quality protection efforts related to agriculture. For example, in recent years a number of USDA agencies have identified water quality as a high priority in their programs and have established and funded a variety of water quality protection programs.

What does the future hold? The third question I want to comment on is: What can we expect in the future as far as governmental actions directed at agricultural sources of pollution?".

The public has a right to expect that Iowa's surface and ground waters will be maintained at such a quality that they can be used as a source of drinking water, for recreation, and for other uses without fear of incurring health problems or encountering objectionable aesthetic conditions. This can be achieved through the cooperative efforts of all Iowans, including those involved in agriculture.

As discussed earlier, Iowa has established a number of programs designed to encourage voluntary adoption of farming practices which can reduce the movement of sediment, nutrients, and pesticides into the state's surface and ground waters. In the near future, the state is likely to continue its support of this voluntary approach, including providing continued funding for the various programs now underway. However, it is important to recognize that success of this voluntary approach in developing, demonstrating, and adopting such "Best Management Practices" is by no means assured, and failure of this approach may well lead to increased regulation.

Water quality is also likely to remain a major national issue, and a number of federal agencies are likely to play a role in nonpoint control efforts. Initially, the federal efforts dealing with agriculture are likely to also emphasize the voluntary approach to solving these problems, with a variety of research, public information, and technical and financial assistance programs being used to encourage and assist farmers in modifying their operations to lessen water quality impacts.

Evidence of increased federal involvement in agricultural water quality issues can be seen by reviewing the provisions of the 1990 Farm Bill. Among the provisions included in the Conservation Title of this bill are:

* a new Agricultural Water Quality Protection Program is established, with a goal of enrolling 10 million acres nationwide under 3-5 year agreements;
* an Environmental Easement Program is set up, to set aside environmentally sensitive areas for long periods of time;
* Integrated Farm Management and Model Farms Programs are authorized, similar to the programs already established in Iowa;
* expanded research efforts are authorized, emphasizing nonpoint pollution issues and improved nutrient and pesticide management; and,
* users of restricted use pesticides will be required to maintain records similar to those now required of commercial applicators.

In many respects, the 1990 Farm Bill can be expected to raise public awareness of agricultural water quality issues in much the same way that the 1985 Farm Bill did for soil conservation. The major exception is that, except for the record keeping requirements for restricted use pesticides, the 1990 Bill relies entirely upon voluntary action by farmers to accomplish its water quality goals.

Will farmers, agribusiness, and other groups in the agricultural community support and work to implement these voluntary water protection initiatives? Past history suggests they may not. The soil conservation movement began more than 50 years ago, and used the voluntary approach to apply conservation

practices on the land. Yet, soil losses nationwide were greater in 1985 than they were in the "dirty 30's", the dust bowl era. As a consequence, Congress passed the 1985 Farm Bill, which has far reaching effects on the way land is farmed. Conservation is now required for farmers with highly erodible land who want to participate in USDA programs.

Recent sociological research also suggests that the voluntary approach may not be highly successful. A recent survey of Iowa farmers characterized Iowa agriculture as "highly dependent on external inputs, and one where strong motivations toward changes are not pre-existing" (Padgitt, S.C., 1990). Few farmers indicated that demonstrations of lower chemical inputs or workshops on alternative farming methods would influence them to reduce chemical use. On the other hand, many farmers indicated they would be more motivated to reduce chemical use if regulations penalized misuse of products or if studies showed the area's ground waters were already contaminated.

The obvious question is "If the voluntary approach fails to accomplish the changes needed to protect water quality, what happens next?". Based upon what has happened in other environmental program areas, it is likely that failure of the voluntary approach will lead to increased regulation of agriculture. In fact, at that point the question may not be "what next", but rather "how, and how soon, will agriculture be regulated". While it is likely that the ongoing voluntary programs will be given a reasonable period to work before a more regulatory approach is adopted, this period will certainly be far shorter than the 50 year period given for voluntary soil conservation programs to work.

Indeed, the trend toward more regulatory approaches is already evident at both the state and federal levels. At the state level, this is reflected by such actions as the changes in state pesticide certification laws, the secondary containment requirements for fertilizer and pesticide storage and handling facilities, and the restrictions on atrazine use.

At a federal level, evidence of the trend toward increased regulation includes the cross-compliance provisions of the 1985 Farm Bill, the new pesticide use record-keeping requirements of the 1990 Farm Bill, and several actions being considered by the US EPA. Perhaps the most far reaching of EPA's proposals is one calling on states to develop site-specific strategies for protection of vulnerable ground waters from contamination by nutrients and pesticides. Under this proposal, state strategies would be expected to utilize a variety of measures to protect vulnerable ground waters, including, where needed, regulations restricting the availability or method of use of certain pesticides. As an incentive for states to develop such strategies, EPA has indicated

that a state's failure to develop a strategy could result in EPA not registering certain pesticides for use within that state.

Other actions being considered by EPA include designating more pesticides as "restricted use", and possibly banning certain registered products which are found in ground waters, adopting drinking water "maximum contaminant levels" or "health advisory levels" for additional pesticides, and adoption of high flow water quality standards for sediments, nutrients, and pesticides.

The Iowa Department of Natural Resources supports the voluntary approach currently being used to address nonpoint pollution from agricultural sources, and believes this approach is far preferable to that of direct regulation. For this approach to be successful, it is essential that all segments of the agricultural community, including farmers, industry, researchers, and governmental agencies work together to support the ongoing water protection programs and the adoption of needed soil conservation and nutrient and pesticide management practices.

At this point, the challenge is clear. Will the agricultural community voluntarily take the actions necessary to protect and improve Iowa's water quality? There are many who say this will not happen. It is up to you to prove them wrong.

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