

ILLINOIS POLLUTION CONTROL BOARD
March 28, 1972

In the matter of)
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PLANT NUTRIENTS) R 71-15
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Opinion of the Board (by Mr. Aldrich).

Plant nutrients are relative newcomers to the growing list of environmental concerns. Illinois is an appropriate state in which to examine the role of nutrients because it has in recent years led all states in the application of major plant nutrients (nitrogen, phosphorus, potassium). The Pollution Control Board in May, 1971, approved proposals for public hearings on the application of fertilizers, animal wastes, and sewage sludge and on controlled access of livestock to streams. The purposes of the hearings were to determine:

1. Whether plant nutrients are creating pollution problems by reaching surface or underground waters in excessive amounts.
2. The present state of knowledge on the extent to which fertilizers and animal manure contribute to pollution problems.
3. Whether steps can be taken to correct pollution problems in the event that problems are identified and agricultural practices are found to be important contributors. Two approaches were to be considered: a) adoption of rules and regulations, and b) reliance upon needed research, education and voluntary changes in practices.
4. The impact of alternative courses of action both on the environment and on food supply and costs.
5. The administrative feasibility of rules and regulations.

When the proposals were distributed for hearing purposes, no decision had been made that regulations would be adopted.

The testimony developed by more than 80 witnesses in ten public hearings combined with extensive exhibits produced a comprehensive record of available information on the status and trends of nitrates and phosphates in streams, the role of crop production practices in determining the plant nutrient content of surface waters and the environmental and economic consequences of alternative practices. But it also revealed major deficiencies in available information on which to base our decision in the matter of plant nutrients.

NITROGEN

Harmeson reported an increase in nitrate content of surface waters since extensive records began in 1945 (Nov. 3, pp. 157-170). The magnitude of the increase is difficult to assess because continuous long-term records at the same sampling sites are lacking. In some streams the Water Quality Standard of 10 mg/l nitrate nitrogen (45 mg/l nitrate), R 71-14, is frequently violated especially in east-central Illinois. Sources of excess nitrates in streams are well known but the magnitude of the contribution of each is unknown. Increases in fertilizer nitrogen and in the acreage of row crops are the most likely contributors. Dr. Kohl described a technique (Dec. 10, pp. 23-41) which he claimed could identify the nitrate in water which traced directly to fertilizer. The methodology was challenged by TVA scientists Edwards (Dec. 10, pp. 207-214) and Hauck (Dec. 10, pp. 233-262). The experts could not resolve the controversy even after extended debate and a subsequent conference. Nor does the record demonstrate any alternative to commercial fertilizer that would provide adequate food without an equal potential for exporting nitrates to surface and groundwater. None of the expert witnesses could say whether the substitution of livestock and human wastes or of nitrogen-fixing legumes for fertilizer nitrogen would reduce the amount of nitrates that leach through or run off the soil.

The record clearly supports the conclusion that within a given set of supporting cultural practices, the greater the amount of nitrogen applied the greater the potential for loss to ground and surface waters (Nov. 3, p. 52). But farmers who produce the highest yields and apply the highest rates of nitrogen may produce a unit of crop with less potentially leachable nitrate than farmers who produce average yields. Surveys reveal that recent increases in nitrogen consumption in Illinois, and for the entire Cornbelt, are due to higher rates being applied on previously underfertilized fields. The proportion of fields that receive more than 150 pounds per acre has decreased in recent years.

Several witnesses questioned the credibility of 10 mg/l nitrate nitrogen (45 mg/l nitrate) as a suitable standard for public drinking and food processing water. The present standard is intended mainly for the protection of infants against possible methemoglobinemia (blue baby syndrome). Testimony in the record supplemented by the exhibits is confusing and inconclusive. The record shows that methemoglobinemia is almost non-existent in Illinois, only one case having been confirmed in Illinois in the past ten years and it was from a private well. Dr. Gelperin reported a relationship between nitrate in drinking water and methemoglobin in pregnant women and infants but found no observable effects during the study period (Aug. 4, pp. 121-123). Numerous examples are cited in the record where the standard is exceeded in farm wells by a factor of two to ten times with no known health effects among humans or livestock. As was pointed out by Dr. Kohl, this does not constitute proof of no harmful effect, but it raises questions on the status of the standard. The nitrate

standard of 10 mg/l nitrate nitrogen for public drinking and food processing water is not new. It was a part of SWB-14 adopted in 1967 and was included in the U. S. Public Health Standards as early as 1962. The question raised is not whether low nitrate is desirable but whether the present standard is justified by an analysis of the benefits and costs of achieving it.

High nitrate content in some farm wells is, according to the record, not traceable to nitrogen fertilizer but rather to septic systems or animal wastes and appears to be most common in the Illinoian glaciation area of southern and western Illinois.

The productivity of Illinois soils is an irreplaceable resource. About 40 percent of the nitrogen and organic matter have been lost from the surface soil as a result of farming. We recognize that the preservation of soil productivity is an important environmental goal but the record does not establish the role of nitrogen fertilizer in achieving it. Commoner asked us to adopt the regulations on which the hearings were based though he did not feel that this would reduce the nitrogen content of waters. It would in his view be a step in the right direction. He maintained that Illinois agriculture was "out of balance" and that nitrogen fertilizer aggravated the situation. He proposed a return to more reliance on organic sources and less on fertilizer. His views are contrary to those of many soil scientists. Furthermore a 40% decline in soil nitrogen and organic matter occurred before the widespread use of nitrogen fertilizer. In any event we prefer to await additional information as indicated below, before imposing any limitations on fertilizer use. Even though many farmers testified that present practices met the proposed standard, to regulate it would limit future increases and we do not have adequate cost-benefit information to justify that result at the present time.

Swanson reported that regulations that reduce the amount of nitrogen fertilizer applied for corn in Illinois would reduce the income of Illinois farmers but would have little effect on food prices. If restrictions were imposed throughout the cornbelt, the burden would shift from farmers to consumers in the form of higher food prices (Ex. 19).

Many farmers testified that because of their intimate and continuing contact with the environment, they have a special sense of stewardship. They alleged that this in combination with the fact that plant nutrients are valuable production factors which are costly to replace, serve as a substantial deterrent to excessive or misapplication of fertilizer. They maintained that, if research identifies problems resulting from fertilizer practices, education programs and economic considerations will be adequate to protect the environmental interests of society. But what may not be excessive from the farmer point of view may be too much for the good of society for his calculation do not include possible adverse effects downstream. Based on the record we feel that research on the optimum economic rates of applied nitrogen is extensive (Aug. 3, pp. 24-30; Ex. 19, p. 5) but deficient in the relationship of rate to the nitrate content of waters which receives the drainage from cropland.

We conclude that the water quality standards for nitrate nitrogen are presently being violated in certain streams of the state and that the potential nitrate problem will grow as the demand for food increases. The record has not demonstrated that health effects have resulted. Deficiencies in available knowledge on the credibility of the nitrate standard, on the contributions of various nitrogen sources to nitrates in water, on the effectiveness of possible control measures and on undesirable side effects on the environment from alternative practices convince us that at this time we should make provision for more information on which to decide the issue rather than to promulgate regulations of unpredictable effectiveness and side effects. Accordingly we shall ask the Institute for Environmental Quality to give high priority to obtaining information on nitrates which will provide a basis for early reconsideration of the matter.

Specifically we request the Institute to develop an implementation plan for achieving the standard of 10 mg/l nitrate nitrogen in public drinking and food processing water or, if Institute studies show that the costs to achieve compliance are not justified by the benefits, to propose a revision. Perhaps additional research will be required in stream sampling, in connection with applications of fertilizer, animal and human wastes, in groundwater hydrology, and in cropping systems before an implementation plan can be developed. We suggest that the Institute also consider the technical feasibility and economic reasonableness of removing nitrates from public drinking and food processing water in case a choice becomes necessary at a future date between nitrate removal versus major adjustments in food production practices in order to reduce the sources of nitrates. Specific suggestions for needed agricultural research are listed in a supplemental opinion by Board Member, Mr. Aldrich.

The position of the Federal EPA appears to be in basic agreement with our decision as indicated in testimony introduced into our record:

"The development of fertilizer application management plans will require full evaluation of the nutrient availability and retention capability of various soil types in particular agricultural areas. The capability of existing programs, such as those of the U. S. Department of Agriculture and State and local Agricultural Agencies should be brought to bear toward developing the essential information for complete watersheds and soil structure types at an early date. Starting now with available information, guidelines for fertilizer application, including optimum and maximum recommended rates should be developed. The voluntary use of the guidelines in the fertilizer program for individual farms should be encouraged. Effective use must be made of the available educational and technical assistance programs at the Federal, State, and local levels" (Ex. 72, p. 10).

PHOSPHORUS

Based on this record and the record in R 70-8 (Effluent Standards), R 70-12 (Des Plaines Water Quality), R 71-10 (Phosphorus in Detergents and other Cleaning Products), and R 71-14 and R 71-20 (Water Quality Standards), we do not now propose to regulate the time and rate of applications of phosphorus in fertilizers. Phosphorus has been shown to be a serious water contaminant in the Fox River as well as in Lake Michigan and other still waters, but not in flowing streams generally. Nor has the evidence stressed the contribution of fertilizer runoff in these Illinois waters subject to serious phosphorus problems. In this connection it should be understood that phosphorus in land runoff is not to be equated to phosphorus in fertilizers. It also includes phosphorus contributed by decaying grass, leaves and other vegetation and erosion from both non-farm and farm areas and live-stock wastes.

Based upon expert testimony by Dr. Ralph Evans, Head of the Water Quality Section of the State Water Survey we stated in the Board Opinion in R 71-10: "The effect of nutrients on flowing midwestern streams has been negligible and there is no substantive evidence supporting the view that phosphorus in these streams is a major water quality degradent."

The behavior of phosphorus fertilizer when applied to the soil is well known. Illinois soils have retention capacities for phosphorus far in excess of the amounts applied in fertilizer. Hence phosphorus in tile drainage effluent is little affected by fertilizer applications. According to Dr. Nelson (Ex. 29(e), Table 4), about one percent of surface-applied phosphorus was carried in solution in surface runoff from a relatively steep slope following heavy rainfall. An additional amount was carried off in association with eroded soil particles. In future hearings we expect to take a closer look at erosion as a source of phosphorus.

From 1962 to 1970 while use of fertilizer phosphorus in Illinois tripled, data from the Illinois State Water Survey show the following:

- the average annual concentration of filterable phosphorus in the Illinois River at Peoria was constant except for excursions above the average in 1963 and 1964.
- neither filterable nor total phosphorus increased in the Kaskaskia River at Shelbyville.
- filterable phosphorus did not increase in representative small streams (Embarrass River, Elkhorn, Seven Mile and Wolf Creeks).

From this record and from others involving phosphorus we believe that research is needed on the relative availability to aquatic plants of phosphorus that is in solution, in organic matter, or adsorbed on soil particles.

Though we have decided that regulations on phosphorus fertilizers should not be imposed at this time we must register our concern for prudent use of fertilizer in order to conserve finite reserves of phosphorus in economically recoverable form for future use. A highly productive soil is a relatively good place to store reserves provided erosion is controlled. But erosion is not completely controlled. Furthermore there is an inexorable slow chemical transformation to relatively less plant-available forms.

FENCING LIVESTOCK FROM STREAMS

The hearing record on the fencing of livestock out of streams except for reasonable access for drinking or crossing is singularly one-sided. No one testified as to the need for such a regulation. Several farmers testified at each of the nine hearings where an opportunity was afforded to the effect that the proposal was unnecessary, unworkable, uneconomic and perhaps environmentally undesirable.

Livestock in and near streams which may at some point be used for public drinking or food processing water is esthetically unpleasant. Furthermore, the Water Quality Criteria book (U. S. Department of Interior) lists leptospirosis as a disease hazard from livestock urine in streams. Dr. Hanson, College of Veterinary Medicine, University of Illinois, reports that there are several serotypes, some carried primarily by wild animals, others by swine, cattle and dogs. The disease is common among domestic livestock and can be contracted by humans from swimming in infected waters.

Since all streams eventually reach waters that are used for public drinking or food processing water, a fencing requirement would apply to all streams. Animals, wild or domesticated, in and near streams are nothing new. When massive herds of buffalo roamed the Illinois prairies, the condition of some streams must have been incredibly bad.

Farmers maintained that as long as the number of livestock did not exceed the carrying capacity of the pasturage, the assimilative capacity of the stream would not be exceeded. The issue, therefore, more appropriately belongs in the hearings on livestock wastes where the matter of wastes from large concentrations of livestock will be considered.

Fencing streams is very costly. Fences will be repeatedly torn out by high water. Fencing will reduce the control of noxious weeds. The high cost of fencing would make uneconomical the utilization of large acreages of rough land for grazing, the only use to which it is suited. As a consequence, farmers would likely increase their acreages of cropland as a means of compensating for their lost income. This would lead to additional floods and erosion which would be more environmentally undesirable than grazing along or crossing streams.

We conclude that at this time we should not require fencing of grazing livestock from streams. The matter will be further examined in the livestock waste hearings in order to assure that the runoff from feedlots and other livestock concentrations does not pollute surface waters. The matter of leptospirosis was not covered in the record. It merits further attention and is being pursued with the Director of the State Department of Public Health and the Department of Veterinary Pathology and Hygiene, University of Illinois.

SLUDGE

The proposal relating to sewage sludge and effluent was intended to limit the application of available nitrogen to the same level as in fertilizer. Since we have not adopted a limit on nitrogen rate, we are not suggesting a regulation on sewage sludge. Adequate safeguards can be developed by the Environmental Protection Agency in connection with site approval augmented by surveillance after the sewage material application is in progress.

Board Member Mr. Aldrich has prepared a Supplemental Opinion in much greater detail on the sections on nitrogen and phosphorus.

I, Christan L. Moffett, Clerk of the Pollution Control Board, certify that the Board adopted the above Opinion this 28th day of March, 1972 by a vote of 5-0.

Christan L. Moffett

