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# INFORMATION GENERATION AND COMMUNICATION TO ESTABLISH ENVIRONMENTAL QUALITY OBJECTIVES\*

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It is now generally accepted that some uses of natural resources have side effects which adversely alter the quality of the physical and biological environment and that public action is necessary to weigh these effects and determine to what extent they are worthwhile in view of the benefits society derives from such uses. Four broad categories of public procedures are utilized for this purpose.

One such category entails the evaluation of the consequences of individual actions at the time the action is proposed and determines whether the result will be socially optimal in view of the estimated effects upon environmental quality. The requirement of federal law that environmental impact statements be prepared and considered before certain kinds of activities are undertaken is the latest procedure of this kind.

A second category of procedures involves limiting or constraining certain kinds of activities that are viewed as adversely affecting environmental quality. Thus with regard to air and water, effluent standards have been widely utilized. Legislation or regulations may specify the quantities of particulate matter and certain chemicals permissible in stack emissions. Frequently the standard is specified in terms of the technology to be applied—such as secondary treatment of sewage. In urban communities the fencing of lots and the planting of shrubbery above a certain height along lot lines may be prohibited and so on.

A third category of procedures involves deciding upon the design of an environment and requiring that future actions be consistent with that design. This is the procedure followed when a master plan is developed for a park or urban community and zoning ordinances are adopted to assure adherence to the master plan.

Closely related to this third category of procedures is a fourth which involves the establishment of environmental quality standards or objectives and then limiting activities so as to assure realization of the standards. Most students of air and water quality management

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consider this to be the preferred procedure for these resources.<sup>1</sup> It is widely accepted that ambient air and water quality standards or objectives should be established and programs of air and water use designed to realize the standards. This procedure requires first the specification of the air or water quality characteristics to be achieved. For water these might include the minimum level of dissolved oxygen, the permissible coliform count and the permissible nutrient concentration. This specification of standards must be followed by programs of resource use and waste disposal that result in realization of the standards. It is this category of procedures that is considered in this article.

Air and water quality objectives or standards are determined through two different but related public processes. One is legislative, involving decisions by publicly elected representatives in Congress, state legislatures, or local legislative bodies. The other process is administrative, involving decisions by executive or regulatory agencies operating in accord with procedures usually prescribed by law. It should be kept in mind that the same piece of legislation may approach a pollution problem in several different ways. It may establish effluent standards by specifying the technologies of waste treatment that will be required. It may go a long way toward specifying ambient air or water quality standards that must be met by, for example, requiring that water quality be such as not to harm fish life. It may specify administrative procedures for establishing either effluent or ambient standards.

This paper is concerned with the establishment of ambient standards through administrative procedures. It undertakes the review of a specific case in which water quality objectives were administratively determined and evaluates the results of this process.

This evaluation is based on the premise that when an ambient air or water quality standard is established through public decision-making processes, society is, in effect, deciding that a higher standard is not worth the cost of realizing it and that a lower standard would result in damages that can be avoided at a cost that is less than the damages. In short, the establishment of standards presumes a weighing of benefits and costs and the selection of a standard that will achieve a social optimum.<sup>2</sup>

Much of the literature on water quality management makes the

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1. For a discussion of the use of ambient standards for water quality management see A. Kneese & B. Bower, *Managing Water Quality: Economics, Technology, Institutions* 131-34 (1968). For a general discussion of the use of standards see Fox, *The Use of Standards in Achieving Appropriate Levels of Tolerance*, 67 *Proc. of Nat'l Acad. of Sci.* 877-86 (1970).

2. A. Kneese & B. Bower, *id.* at 131-132.

tacit assumption that the establishment of ambient air and water quality standards is a relatively unimportant part of the total process of water quality management.<sup>3</sup> Emphasis is placed instead upon the process of achieving the standards. It is accepted that standards will be determined by a rather crude benefit-cost assessment to which little importance is attached.

The underlying reasoning appears to be that since it is difficult if not impossible to secure the information, and especially quantifiable information, this part of the process is not very important. This is an odd position for economists, in particular, to take because a least cost system for achieving the wrong result can hardly be considered an efficient solution.<sup>4</sup> The view underlying this paper is that the specification of ambient standards is an important part of the process of achieving optimal air and water quality conditions.

In considering the matter of establishing standards it must be recognized that it is impracticable to secure the necessary information and measure effects so as to determine analytically what an optimal standard is in a given instance. While this is always true to some degree with regard to social values, water quality management poses some particularly difficult problems in securing data and measuring values. Since values are finally measured through public decision-making processes an effort to determine whether standards reflect social preferences must evaluate, in effect, the process by which the standard is established. No elaborate framework for evaluating the standard-setting process has been developed for the purposes of this paper. It has been simply assumed that (a) standards should reflect the value preferences of those affected and (b) that those affected (or their representatives) must be informed about the consequences of alternative decisions. It is not a simple task to determine in a given case, such as the one examined in this paper, whether these criteria have or have not in fact been met. However,

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3. For example, Kneese & Bower, *supra* note 1, at 131, assume that ". . . standards will be based on some, usually vague, consideration of damage costs vs. costs of quality improvement." Wm. J. Baumol and Wallace E. Oates assume the selection of standards poses no significant problem. They state that "On the basis of evidence concerning the effects of unclean air on health or of polluted water on fish life, one may, for example, decide that the sulfur-dioxide content of the atmosphere in the city should not exceed x percent, or that the oxygen demand of the foreign matter contained in a waterway should not exceed level y. . . . These acceptability standards . . . then amount to a set of constraints that society places on its activities." Baumol & Wallace, *The Use of Standards and Prices for Protection of the Environment*, Swed. J. Econ. (1971). Similarly A. Myrick Freeman III and Robert H. Haveman accept without questioning the standard setting procedures of government agencies and direct their attention entirely to how such standards might be achieved efficiently. See Freeman & Haveman, *Residuals Charges for Pollution Control: A Policy Evaluation*, 177 Science 322-29 (1972).

4. This, of course, is what much of the criticism of United States water development agencies has been about. They developed least-cost systems for achieving dubious objectives!

the case study seeks to assess the appropriateness of the standards established in a particular instance by exploring:

- (a) the extent to which the value preferences of those affected were weighed and
- (b) whether those involved in the decision processes made their choices on the basis of the kind of information it is practicable to generate as a foundation for intelligent decision-making.

In considering the kind of information that is important in establishing standards, it is assumed that cost and benefit information expressed in monetary terms will be most useful. Where this cannot be provided it is assumed that data indicating physical and biological consequences will be helpful since such information provides a basis to which the decision-maker can apply his own value standards.

#### ESTABLISHING THE STANDARDS<sup>5</sup>

The federal water pollution control legislation enacted in 1965 called for establishment of water quality standards for interstate streams. Standards were to be developed by the state and subject to approval by the Secretary of the Interior. In August 1966, legislation became effective in the State of Wisconsin requiring the establishment of water quality standards in intrastate streams as well.<sup>6</sup> In September, 1966 the Department of Resource Development of the State of Wisconsin initiated action to establish standards on both interstate and intrastate streams. This case study focuses upon the process whereby standards were officially established in June 1968 for the Wisconsin River, an intrastate stream.

The process of arriving at standards involved two major stages. In the first stage, the water quality characteristics required to accommodate each of several different uses were determined. For this purpose five classes of standards were established. These will not be described in detail but they may be briefly defined as follows:<sup>7</sup>

1. *Minimum standards.* This is the lowest classification and is designed to avoid nuisance conditions caused by heavily polluted water.
2. *Public water supply.* This classification applies to surface waters that are used as a source of public water supply. The standards are specified in terms of coliform count, dissolved solids and pH. Also, the water must be treatable to meet U.S. Public Health Service Drinking

5. Wible, *Information for Establishing Water Quality Levels*, 2 Water Resources Policy in Wisconsin (U. Wis. Water Resources Center, 1971).

6. Wis. Stat. Ann. ch. 144 (Supp. 1972-73).

7. Adopted by the Resource Development Board Apr. 16, 1967, and published in the Wisconsin Register May 1967.

Water Standards and it must not contain constituents hazardous to health.

3. *Fish and other aquatic life.* The standards are specified in terms of dissolved oxygen, temperature, pH and substances toxic to fish and other aquatic life. For trout waters, effluents should not adversely affect trout populations.

4. *Recreational use.* The standard for this use is in terms of the presence of fecal coliform and general coliform. A distinction is made between "whole body contact" and "partial body contact" water sports.

5. *Industrial and cooling water use.* The standard for this use is specified in terms of dissolved oxygen (lower than for fish and aquatic life), dissolved solids (higher than for drinking water), pH and temperature. In general the standards for this use are less stringent than for fishing uses.

The process by which the use standards were established is of interest. It was viewed, as in most jurisdictions, as a technical matter. Staff members of the State Department of Resource Development consulted standard texts on such matters, the standards adopted in other jurisdictions, and the United States Public Health Service (USPHS) water pollution control standards published in 1953. A draft of standards developed from these sources was circulated to other state agencies having a direct interest in water quality and comments were solicited thereon. A revised draft was produced to take into account the comments received. Public hearings were later held on the use standards as outlined above, and the category of use which it was proposed should apply to each stream or section thereof in the State.

Although public hearings were held on the use standards the standards were defined in terms which virtually excluded everyone from intelligent evaluation of them except those technically trained or those capable of employing technical consultants. No one participating in the public hearing on the Wisconsin River (discussed below) questioned the use standards. It is also noteworthy that the determination of use standards involves significant value judgements. It is not true, for example, that coliform counts somewhat below the standards specified for recreation use involve no risk to health or that counts somewhat higher than the standard involve risks to health that are necessarily greater than people are willing to tolerate. Later the question of whether such value judgements must be made by technically trained individuals will be examined.

The second stage in the process of arriving at water quality standards involved a determination of what use designation (such as

“recreation” or “public water supply”) should apply to each section of stream in the state. The State Board charged with the responsibility for establishing policy and approving water quality standards announced that

It is . . . a goal of the standards to restore and maintain the waters of the state as suitable for public water supply, whole body contact recreation, and the reproduction of game fish and minnows. It is the working objective of the Department to achieve these goals within ten years.<sup>8</sup>

In accord with the foregoing policy it was decided that all Wisconsin water should meet the use standards for recreation and for fish and aquatic life, except where a use permitting a lower standard is specifically designated. The exceptions that might be made to the recreation and fish and aquatic life standards would be for a temporary period only, during which waste dischargers would be expected to reduce or upgrade their effluents.

The announcement for the hearings on intrastate water quality standard specified these policies and listed the reaches of a number of rivers the Department proposed to except from the general standards for recreation and fish and aquatic life and proposed the use designations that would apply to these excepted reaches.<sup>9</sup> For the mainstem of the Wisconsin River nine sections were to have use designations permitting lower standards than uses involving whole body contact recreation and fish and aquatic life.

The procedures whereby these exceptions were first proposed and final use designations officially established may be briefly summarized as follows:

1. Responsibility for determining what the proposed exceptions should be was assigned to regional offices of the Department (The relevant sections of the Wisconsin River were in Regions I and IV). The regional offices based their determinations upon water quality river surveys, consultation with a regional advisory board, advice of interested parties, and advice of the central office in Madison.
2. Hearings on the proposed use standards and stream designations were announced and widely advertised. At these hearings all individuals who wished to speak were given an opportunity to be heard.
3. Subsequent to the hearing there was consideration of the

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8. As stated in the “Announcement of Public Hearings in Connection with Establishment of Water Quality Standards and Water Use Classifications for Intrastate Surface Waters in Wisconsin”, Wis. Dept. of Natural Resources, Nov. 3, 1967.

9. *Id.*

conclusions of the two regions with regard to the reach of the Wisconsin River that flowed from Region IV into Region I. Each regional office then submitted its recommendations to the central office of the Department.

4. The Natural Resources Board of the State Department of Natural Resources<sup>10</sup> met and made its final determinations.

There are a number of aspects of this process that merit further description.

First, 56 people attended the public hearing on the Wisconsin River held in Wisconsin Rapids on November 20, 1967. Of this total 19 were representatives of the waste discharging industry, either company or union representatives and 16 were associated with state agencies, either as agency employees or members of the regional advisory Board. There were present only three representatives of conservation organizations, one representative of the League of Women Voters and one unaffiliated citizen. The remainder were from the news media, the power company, local municipalities, the federal S.C.S. and two universities. This is not meant to imply that only three representatives present held a conservation viewpoint. Yet, the evidence suggests that a preponderant proportion of those present were identified with the waste discharging interests.

Second, the presentations at the hearings were dominated by the waste discharging interests. Twelve statements were made at the hearing. One was an opening statement by the Chairman of the Regional Advisory Board. Another was a description of the role of the Wisconsin Valley Improvement Company which owns and operates the reservoir system that regulates the flow of the river in the interest of power production and industrial water supply. Three presentations were made by representatives of unions whose members are employed by the industry. And the remaining seven were statements by major dischargers (six from the pulp and paper industry). Union representatives generally pleaded for consideration of the impact upon the regional economy in setting the standards. The representatives of the waste discharging industries, with one exception, requested lower standards for specific reaches than those proposed. No one spoke in behalf of higher standards than those proposed by the Department.

Third, it is evident from the correspondence in the Department files that, apart from its activity at the hearings, the waste discharging

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10. During the time when standards were being established the natural resources activities of the State of Wisconsin were being recognized. The Department of Resource Development which initiated the process later became a division in a Department of Natural Resources and the Resources Development Board became the Natural Resources Board.



industry had considerable communication with departmental officials before the hearings as the proposed use designations were being determined and after the hearings before the final decisions were reached. For example, on October 16 (prior to the hearing) the regional director of Region IV wrote the central office describing Advisory Board conclusions and included comments received from the pulp and paper companies and the Wisconsin Valley Improvement Company. On November 30 (after the hearing) Region IV Advisory Board met. Present at this meeting were a number of representatives from industrial water users. Eight of these spoke in behalf of pulp and paper companies. Their statements were included as part of the hearing record because they were presented within ten days of the hearing. In January, when the negotiations between the two regions were in process about the standards which should apply on the reach of the river which flows from Region IV to Region I, Region IV sent its recommendations to Region I and supported its proposals by two statements made by pulp and paper company representatives at the public hearings. During this period only one letter was received from a conservation organization—the Sierra Club—and that was an inquiry about the status of plans to establish intrastate standards.

In describing what occurred, it is not intended to imply that the actions by waste dischargers were in any way unethical or inappropriate. Our sole purpose in summarizing the foregoing record is to demonstrate that the waste dischargers had a much more active voice in the processes by which the standards were established for the Wisconsin River than any other non-governmental group.

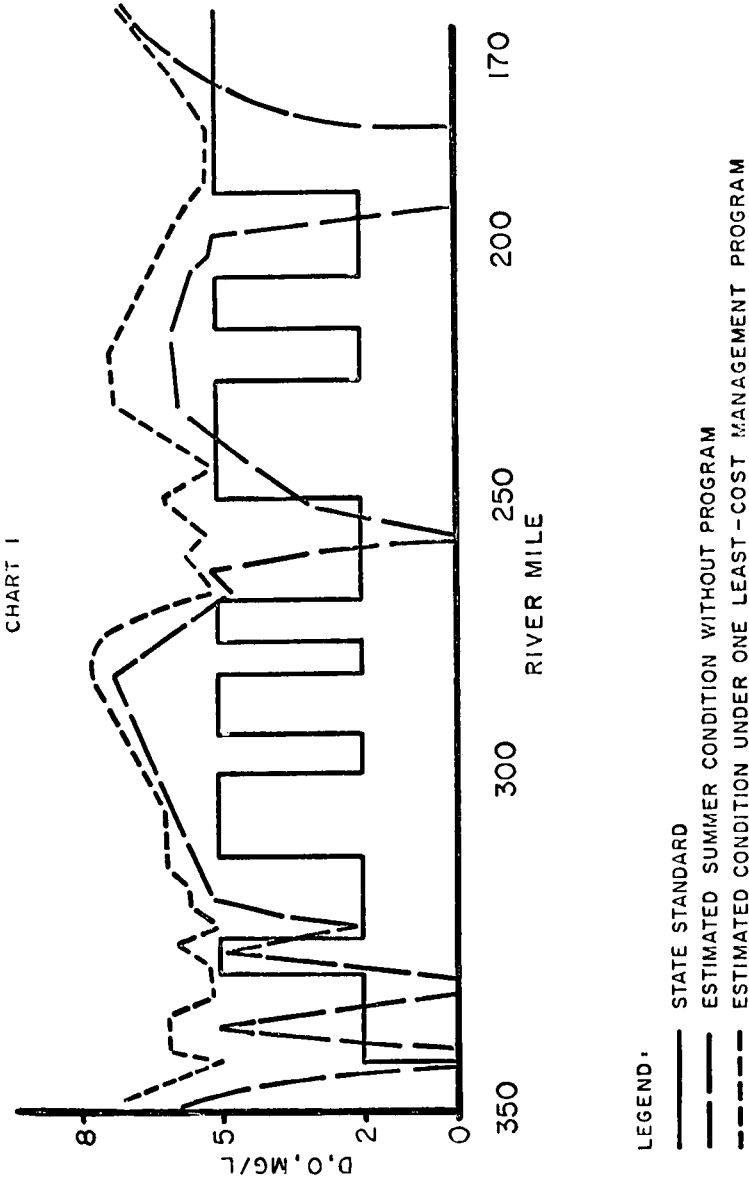
#### TECHNICAL EVALUATION OF THE STANDARDS ESTABLISHED

Whether a given water quality is desirable is a subjective judgement. However, it is practicable to make a technical determination of what in fact would happen to the water quality of the river if a serious effort is made to attain water quality objectives for particular reaches. In the case of the Wisconsin River an inter-disciplinary research effort at the University of Wisconsin examined alternative ways of achieving different water quality objectives.<sup>11</sup> This study provides an insight into the appropriateness of the standards adopted by the State of Wisconsin for the Wisconsin River.

Chart I is a profile that indicates the dissolved oxygen standards implied by the use designations finally adopted for the 180 miles of the river most affected by industrial waste discharges. While this chart does not reflect parameters other than dissolved oxygen it

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11. Institutional Design for Water Quality Management: A Case Study of the Wisconsin River Basin (U. Wis. Water Resources Center, 1970).



Source: Volume I - "Water Resources Policy in Wisconsin: A Summary Assessment" by Irving K. Fox, Water Resources Center, University of Wisconsin, Madison 1972.

indicates quite well the differences in the standards adopted. The standard of zero dissolved oxygen in the upstream section reflects the minimum standard for that reach which was adopted because of the large volume of pulp and paper mill wastes discharged at Rhineland. The standard of 2 mg/1 for alternate sections downstream reflects a conclusion that in each of these sections it would be difficult to achieve the 5 mg/1 required by the fishing and aquatic life standards because of industrial waste discharges.

The studies at the University of Wisconsin indicated that in a sense the standards adopted were quite unrealistic. They showed in particular that *if the fishing and aquatic life standards were met in the reaches specified for such uses, all reaches would meet the fishing and aquatic life standards.* Chart I also indicates the dissolved oxygen levels along the river if programs were implemented to achieve the adopted standards.

Two other points emerge from the study which also have some significance for the establishment of standards. One is that the fish and aquatic life standards could be achieved at what would appear to be relatively reasonable social costs. The study indicates that these standards could be achieved at a cost between 0.8% and 1.7% of value of the product of the waste discharging mills on the river.<sup>12</sup> The other point is that standards or objectives should take into account a risk factor. Because of variations in stream flow the cost of assuring the realization of a specified standard increases dramatically as the risk of violation becomes minimal. This result is illustrated by Table I.

In short it is evident that neither the state officials who proposed the standards nor the waste dischargers (let alone the conservation interests) understood at all well the implications of the standards that were proposed and eventually adopted. If the waste dischargers were in fact to be accommodated by lower standards, such standards would

TABLE I  
Effect of Reducing Risk Level Upon Water Quality Management Costs\*

Risk Level	Annual System Cost (\$ 000)
50%	3,611
20%	3,930
10%	4,467
1%	5,276

\*Other variables are kept constant and same standards are pursued in each case.

Source: From Table 5, page 84 of *Institutional Design for Water Quality Management: A Case Study of the Wisconsin River Basin*. Vol. I, University of Wisconsin, Water Resources Center 1970.

12. *Id.* vol. 1, at 91.

have needed to apply to most of the 180 miles depicted in Chart I. On the other hand if the standards adopted were to be met, the lower standards for some reaches were unnecessary. No one had the information to arrive at standards in an intelligent fashion.

### INTERPRETATION

Certainly this one case study does not tell us how to arrive at environmental quality objectives that will achieve a socially optimal result. However, it helps to establish the nature of the problem and serves to substantiate what other experience and logical inference would indicate one should expect. The issues it raises relate to (1) how objectives or standards should be described so that they can be communicated to those affected, (2) the role of environment quality management planning in setting objectives and standards, and (3) the measurement of value preferences of all elements of the public in establishing objectives and standards.

#### *A. Description of Standards*

The probable effects of pollutants upon public health or biota can only be determined by an individual with specialized training. He can say that a certain concentration of pollutants will destroy specified species of fish or be very injurious to fish. Frequently, however, the specialist is quite uncertain about the consequences of a given concentration of pollutants and may only be able to say that since high concentrations of a pollutant are toxic, lower concentrations offer some risk. Thus when standards are specified as they were in Wisconsin they mean little to the layman, because the terminology is unfamiliar and they do not convey the fact that these standards are based upon estimates of risk which cannot be objectively determined.

If we are in fact serious about providing the public with the opportunity to express its preferences where value judgements are involved it would appear essential that the mystery should be removed from environmental quality standards and objectives. The proposed standard for a toxic pollutant might well state "that  $x$  concentration of the pollutant kills half the population of stickle-back fish within 48 hours and while it is not known precisely what the effects of lesser concentrations are, the proposed standards would permit concentration of only  $1/20x$ ". The statement might go on to say what an expert considers to be the risk associated with the proposed standards and/or what the nature of the uncertainty is with regard to the standard. It seems only appropriate that the public should know the basis of proposed water quality objectives and be given the opportunity to consider whether the risks involved because

of lack of knowledge about consequences are worth taking. The specialist can define the risk or uncertainty but he has no particular competence to decide what kinds of risks or uncertainties society should accept.

### *B. Planning and the Establishment of Environmental Quality Objectives*

This case study emphasizes the point that Matthew Holden has made so well that pollution control involves bargaining among the interested parties.<sup>13</sup> In this case the interested parties might be crudely classified into three groups: (a) the State standard setting staff (b) the waste discharging interests and (c) the other users of the river. The particular contribution of this case study is that it demonstrates that the bargaining process does not operate effectively when the parties involved are uninformed about the consequences of alternative decisions. Neither the industry, the State nor the conservation interests understood the behavior of the river well enough to estimate the practicality of alternative standards. These were knowledgeable individuals who had collected and reviewed data on the river for many years but they had made no systematic effort to develop predictive techniques. The industry succeeded in convincing the State that nine reaches of the river should have lower standards than those generally required in the state so as to reduce the burden upon the industry of up-grading its waste discharges. But the industry had misinterpreted its self-interest because if the State had insisted that the industry meet the standards finally adopted, the entire river would have met the higher standards and those interested in higher standards than those adopted would have gotten more than they expected. The Staff of the Department of Natural Resources considered modification of the standards in light of the finding of the study. However, no action has been taken, possibly because of impending federal legislation, eventually enacted as the amendments of 1972 to the Federal Water Pollution Control Act.

The erroneous estimates of consequences made by the participants in this case argue strongly for technical studies in advance of the establishment of standards so that at least the behavior of the river is understood. The Wisconsin River Project also indicates that studies of the costs and returns associated with alternative sets of standards are feasible and it is evident that such studies would enrich the understanding of those involved in the decision-making process. Illustrations of the kind of information that was developed are

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13. M. Holden, *Pollution Control as a Bargaining Process: An Essay on Regulatory Decision-Making* (Cornell U. Water Resources Center Publication No. 9, 1966).

presented in the paper by Mr. Anthony H. J. Dorsey published in this issue of the Natural Resources Journal. These data indicate system costs under alternative constraints and risk factors. There is no doubt that this kind of evaluation of alternatives could be extended. It is significant that the union representatives who testified at the Wisconsin River hearing cited earlier were not pleading for a change in the proposed standards. They expressed a concern about the possible effects of the standards on the economic well-being of the union membership. Information that could have been generated about the economic consequence of the proposed standards would have helped such individuals in deciding whether the proposed standard would in fact adversely affect their interests.

This experience leads to the conclusion that instead of emphasizing the establishment of standards it would be better to develop alternative programs of water quality management. For each of these alternative programs, it would be desirable to indicate where treatment facilities would be provided, what reductions in waste loadings would be required at specific locations, what the costs would be and who would bear them, what water quality characteristics would result, and what benefits would accrue to society from the program. Even if such information could not be developed to a high degree of accuracy, approximate estimates would, it is believed, provide a basis for the interested groups to bargain more intelligently about what should be done. Thus instead of arguing about whether an abstract standard is desirable without knowing much about what the costs, their incidence and the benefits would be, each of the interested parties could bargain in light of reasonably good knowledge of consequences.

It will be argued by some that accurate estimates of costs cannot be determined because the costs of alternatives available to industry cannot be known to public planning agencies.<sup>14</sup> This is true, *but a public agency can determine what it would cost a public agency to deal with a given kind and quantity of waste.* The more ingenious agency will be able to estimate the costs of some of the options available to industry. Preliminary programs based upon reliable cost estimates that the public agency is capable of making provide a good basis for negotiation. Such a program would indicate the amount and location of waste reductions that would be necessary to achieve specified levels of quality and the maximum cost of achieving such levels. It is conceivable that the standard arrived at in this fashion would be lower than would be justified if accurate cost estimates

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14. It is generally accepted that approximate estimates of cost can be made. See, e.g., Freeman and Haveman, *supra* note 3, at 324.

could be made of the option available to a waste discharging industry. This certainly is a possible result. But in recognizing such a possibility it is only reasonable to conclude that bargaining conducted on the basis of this much information would come closer to achieving an optimal standard than bargaining conducted on the basis of much less information and that public agency personnel could, through access to industrial literature and knowledge of the industry in the region, gain an understanding of the options available to industry.

### *The Measurement of Value Preferences*

The most perplexing problem posed by the case study relates to the measurement of value preferences through administrative procedures. Is it reasonable to conclude that the kind of procedure described whereby standards were established by an administrative agency after public expression of views can produce a socially optimal result? Certainly no individual or group can be faulted for the way the procedure was conducted in the case of the Wisconsin River. State officials functioned in a conscientious fashion. Industry representatives cannot be criticized for pressing their case in the hearings and on other occasions because it is their responsibility to represent the interests of their firms. The fact remains that while the industry view was well articulated, other views were not expressed equally well. This meant that the state administrative machinery had to bear almost the full burden of reflecting the views of other members of society. While the information may have been inadequate, there is no positive evidence that the state agency did not weigh the available information in accord with the social preferences of the people of the State of Wisconsin. It is evident that it was necessary for the State to arrive at its judgement on the basis of well articulated expressions of interest by the industry and a weak expression of views by other interests.

Mancur Olson and others have demonstrated that the kind of public participation reflected in the Wisconsin River standard setting processes is what one should expect.<sup>15</sup> The literature on public regulation quite clearly indicates that one cannot rely upon an administrative body to weigh the preferences of all interests in society in the absence of active participation by those interests.<sup>16</sup> The full range of public preferences may have been taken into account by the Department of Natural Resources in arriving at standards for the Wisconsin River but the literature on public regulation suggests that

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15. M. Olson, *The Logic of Collective Action* (1963).

16. For an excellent empirical study of the limitations of regulatory processes see R. Noll, *Reforming Regulation* (1971).

such a condition cannot be expected to continue over an indefinite period. Soon the regulatory agency tends to reflect the interests of the regulated.

The answer to this problem is not self-evident and space does not permit the exploration of alternative possibilities for dealing with it in this paper. This case study does, however, help define the issues that must be addressed.

It would appear from the Wisconsin River experience that one of the fundamental questions is that of how to motivate public agencies to generate information about the alternative water quality management programs that might be undertaken. Without such information, no group can make an intelligent determination of where its self-interest lies so that realistic bargaining can take place. The fact that so little in the way of alternative regional water quality management programs has been produced over the country leads one to wonder what obstacles stand in the way of such activities. This case study offers no answer to that question.

The other fundamental question is that of how to secure a balanced reflection of preferences in selecting environmental quality objective in view of the fact that the waste dischargers can generally invest more time and energy in articulating their views than other interests. One possible answer is that administrative procedures are inappropriate and that objectives or standards should finally be determined by legislative bodies, possible at a regional level. An alternative possibility is to establish in one way or another advocacy bodies to represent the less well organized interests. These alternatives pose such a large array of problems and issues that it would be impracticable to explore them in this paper.

### CONCLUSION

In view of the grand objectives and enormous effort to deal with water pollution envisaged by the recent amendments to the Federal Water Pollution Control legislation<sup>17</sup> the analysis in this paper may seem irrelevant. Yet while that legislation relies to a large extent upon effluent standards by specifying the technologies to be utilized it also provides for the establishment of ambient water quality standards. This study may be relevant to that aspect of the legislation. Of more fundamental importance is whether this new legislation as it is implemented will in fact reflect reasonably well a social optimum in each and every waterway in the country. If it does not, there may be a renewed interest in defining more precisely what constitutes the best solutions to water quality problems. This case study, it is believed,

17. 43 U.S.C. §390G (1964), amending 33 U.S.C. §406 *et. seq.* (1964).



would provide some small contribution to such an endeavor. Certainly it does not provide clear guidance to the solution of the problem of establishing environmental quality objectives. Above all it suggests that too little research effort has been devoted to the examination of specific situations and too many generalizations may have been based upon theoretical analysis alone.