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IMPACT OF POWER PLANTS ON AQUATIC SYSTEMS: A SOCIAL PERSPECTIVE[1,2]

Charles C. Coutant, Ph.D.
Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

This workshop was organized to assist the Electric Power Research Institute in its planning for research in the aquatic effects of thermal electric power stations. Formulation of a research plan must take into account both the technical level of understanding of such effects, and the social framework in which such information is needed. I shall attempt to briefly characterize the current social perspective and to draw some conclusions from it that may influence our planning for aquatic research.

There is one social issue which is foremost in the minds of these who must build or regulate power plant cooling systems. This issue is implementation of Public Law 92-500, the 1972 Water Pollution Control Act Amendments. This law is the latest water pollution control legislation at the federal level, and as such it preempts the previous directions of thermal effluent control.

Those who have followed the implementation of this law recognize that it is very complex, and that the interpretation and application of it is hotly disputed by members of Congress and their staffs who fashioned it. The dispute has been particularly acute with respect to the steam electric power industry. A National Commission on Water Quality was formed to study the effects of the law and to recommend any changes deemed necessary to make it workable.

Very simplistically, the law requires that steam electric plants use the "best practicable control technology currently available" (BPT) by July 1, 1977, and "best available technology economically achievable" (BAT) by July 1, 1983--as defined by the Administrator of the Environmental Protection Agency (EPA).

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There is a 1985 goal of complete elimination of "the discharge of pollutants into the navigable waters." An interim goal for 1983 was established that "wherever attainable ... water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water ..." shall be achieved. The EPA guidelines for this industry in effect characterize what is in place today as compliance with the 1977 guideline. The "best available technology" has been determined to be closed cycle cooling, in particular, the mechanical draft cooling tower.

There are several unique features for handling steam electric power plants under PL 92-500 which are of direct concern to this workshop. Under Section 316(a) the owner or operator of such a point source may secure a less strict effluent limitation for "the thermal component of any discharge" if he can demonstrate that a lower level "will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water." EPA has been preparing a document describing how it will apply this provision to determine exemptions, but the document is still in draft form. An additional requirement is imposed in Section 316(b) that "cooling water intake structures reflect the best technology available for minimizing adverse environmental impact." Once "any point source of a discharge having a thermal component" meets applicable conditions, it "shall not be subject to any more stringent effluent limitation with respect to the thermal component of its discharge during a ten year period ..." whereas other permits issued under the Act are authorized for periods up to five years [Section 316(c)]. There is currently a legal question over whether this phrase exempts plants which receive 316(a) exemptions from meeting any state water quality standards. Actually, all three of these Section 316 modifications to the general effluent limitations requirements are available not only to steam electric power plants but also to any point source discharger with a "thermal component" to its discharge.

Chemicals complicate implementation of the law. Certain chemical additives intended to reduce biological growths such as algae or control scale in the plants are toxic and raise questions as to the applicability of other Public

Law 92-500 provisions relating to toxic substances. The status of these provisions is even less certain than are the thermal effluent limitations because of the difficulty of determining what will be used as a measure of toxicity. Even with closed cooling systems there must ultimately be a "blowdown" with a discharge of some kind to handled. The requirement that the cooling systems be "off stream" also raises the relative consumption of water. Where dissolved salts already present problems, as in the Colorado River basin, reductions in quantity can also lead to higher salt concentrations that impair uses, particularly for irrigation.

According to the Utilities Water Act Group, the costs of EPA's effluent limitations for steam electric power are the highest for any industrial category, and represent one-half of the estimated total industrial cost of complying with PL 92-500. The National Commission on Water Quality is currently examining this cost question in relationship to the benefits presumed to accrue. If the costs really do vastly outweigh benefits, then having some exemption procedures seems logical.

The crucial questions now facing the electric power industry in regard to cooling systems and siting of power plants revolve around application of Section 316(a) and 316(b). What are reasonable technical criteria for "protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife?" In many respects the technical questions are similar to those asked earlier with respect to ambient Water Quality Standards which were mandated under the 1965 Water Pollution Control Act Ammendments. The National Environmental Policy Act of 1969 also mandated careful assessments of effects on a technical basis. The decision-making process in each of these cases is completely different, however, leaving much ambiguity over what really should be national policy in this area.

For the practitioners of aquatic ecology, the current social picture revolving around PL 92-500 projects some awesome consequences. An apparent intent of Congress in passing PL 92-500, that the need for extensive and costly research and analysis of the effects of water pollution would be obviated by simply mandating that discharges cease, has not been upheld. In the case of thermal

effluents, it was probably assumed that Section 316(a) would allow a few exceptions from thermal effluent limitations, but that the overall objective would still be attained. Quite to the contrary, there could be a vastly accelerating demand for aquatic research and analysis should most utilities choose to select the low-cost, once-through cooling and to defend it as environmentally acceptable through the 316(a) route. Meeting this demand in the next 5 years will be hampered by a lack of qualified ecologists, biologists, taxonomists and other supporting manpower. This lack could seriously delay effective, high-quality, and timely conduct of the detailed studies needed to comply with the Section 316(a) variance procedure. Manpower in the field of aquatic ecology is already spread thin by similar study requirements by the Nuclear Regulatory Commission (formerly AEC) and various state agencies.

The need for "generic" technical data, i.e. scientific findings having broad application to many power plant sites, appears to be acute. Wherever information can be developed on typical responses of particular species of organisms, or of particular kinds of ecosystems, the results will be invaluable for the savings in both money and time. Present guidelines for applying for exemptions from thermal discharge limitations include selection of Representative, Important Species. Concentrated efforts to determine thermal and other requirements of such species would seem to be extremely timely.

Emphasis of the law on "balanced, indigenous population(s)" would seem to press for assessment of aquatic effects on the population, community or ecosystem levels. We may wish to quibble over definition of indigenous, but the orientation of concern is clearly above the level of individual organisms. Three years ago (1) I illustrated a progression of ecological thinking regarding assessment of power plant impacts (Figure 1). While we have become fairly adept at identifying sources of potential biological damage, and have gathered a large amount of data on direct biological damage to small samples of organisms (e.g. lethal temperatures), we have only begun to project those biological damages to the higher levels of ecosystem organization. Those meagre beginnings aren't going to be enough to satisfy PL 92-500 Section 316(a),

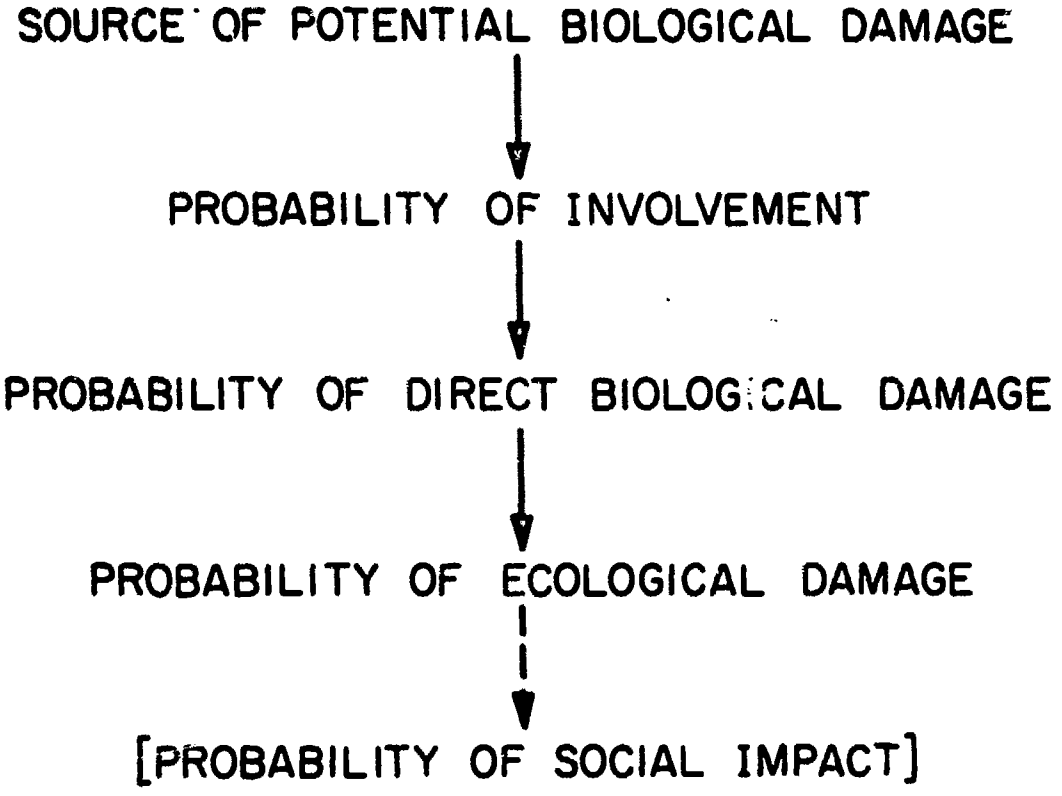

FIGURE 1. PROGRESSION OF ECOLOGICAL THINKING IN RELATION TO ASSESSING THE IMPACT OF POWER PLANTS

if the Regional Administrators of EPA take the broadly ecological view that some authors of PL 92 500 insist upon.

The law also presumes that aquatic impacts of power plants are predictable. Our field is assumed to have a high level of data synthesis which will let us predict the impacts of power plants that are still on the drawing board. I wish this were the case. We must spend a great deal more effort in the area of simulation modeling of population dynamics so that the information that we do have can be viewed and used in a predictive context, and so that we obtain a clearer idea of the most critical information which we lack. I want to point out the work of Saila and his colleagues working with winter flounder, and Van Winkle and his colleagues working with striped bass as excellent examples of work that should be emulated.

Social forces are clearly pressing aquatic ecologists faster than they have been moving previously -- faster in terms of amount of effort expended, and faster in terms of broadening the conceptual base for quantitative analysis. How we as ecologists or as members of functionally related disciplines respond in our research and development outlines is crucial. Leaping to the challenge may be the proper response in some cases, but pragmatic assessment of what questions we can reasonably be expected to answer (especially in a short time) may also be required.

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