Summer 1970

Thermal Electric Power and Water Pollution: A Sitting Approach

Billy Darrell McDaniel

Follow this and additional works at: https://www.repository.law.indiana.edu/ilj

Part of the Energy and Utilities Law Commons, Environmental Law Commons, and the Water Law Commons

Recommended Citation
Available at: https://www.repository.law.indiana.edu/ilj/vol46/iss1/3

This Comment is brought to you for free and open access by the Law School Journals at Digital Repository @ Maurer Law. It has been accepted for inclusion in Indiana Law Journal by an authorized editor of Digital Repository @ Maurer Law. For more information, please contact rvaughan@indiana.edu.
COMMENT

THERMAL ELECTRIC POWER AND WATER POLLUTION: A SITING APPROACH†

The primary environmental control of life is temperature.¹ Temperature increases of merely ten Fahrenheit degrees cause such severe ecological imbalance that literally thousands of aquatic species alter their life patterns.² Of contemporary scientific concern is that an un-

† This paper was initially prepared for a Colloquium on Environmental Quality conducted by Associate Professor A. Dan Tarlock of the Indiana University School of Law.

1. Clark, Thermal Pollution and Aquatic Life, 220 SCIENTIFIC AMERICAN, March 1969, at 18, 19 [hereinafter cited as Clark, Thermal Pollution and Aquatic Life]. Clark is assistant director of the Sandy Hook Marine Laboratory of the United States Bureau of Sport Fisheries and Wildlife.

No attempt is made in this paper to analyze the law of any state; the focus is upon the identification of typical and recurring problems affecting the electric power industry. Citations to states are not exhaustive, but are merely indicative of the states confronted with the problem under discussion.

2. See generally V. Kennedy & J. Mihursky, Bibliography on the Effects of Temperature in the Aquatic Environment, May, 1967 (obtainable from the Natural Resources Institute, University of Maryland, Prince Frederick, Maryland, Contribution No. 24) reprinted in Hearings on the Extent to Which Environmental Factors Are Considered in Selecting Powerplant Sites, with Particular Emphasis on the Ecological Effects of the Discharge of Waste Heat into Rivers, Lakes, Estuaries, and Coastal Waters Before the Subcomm. on Air and Water Pollution of the Senate Committee on Public Works, 90th Cong., 2nd Sess., 471-568 (1968) [hereinafter cited as 1968 Hearings] and 1968 Hearings, 90-172 (statement of Dr. F. J. Trembley, Professor of Ecology, Lehigh University, Bethlehem, Pa., and statement & testimony of Dr. J. Mihursky, Natural Resources Institute, University of Maryland, Prince Frederick, Maryland). The Subcommittee for Fish, Other Aquatic Life, and Wildlife of the National Technical Advisory Committee on Water Quality Criteria (NTAC), ecologists appointed by the Federal Water Pollution Control Administration to recommend criteria for the protection of aquatic resources, made recommendations for guarding against excessive temperature increases. For freshwater organisms, the NTAC recommended that heat should not be added to a stream during any month in excess of the amount which will raise the natural ambient temperature at the expected minimum daily flow for that month more than 5 degrees Fahrenheit. In lakes the temperature of the upper layer of water, see note 22 infra, should not be raised more than 3 degrees based on the monthly average of the maximum daily temperature. Furthermore, the normal daily and seasonal temperature variations should be maintained. However,

because of the large number of trout and salmon waters which have been destroyed, made marginal, or nonproductive, remaining trout and salmon waters must be protected if this resource is to be preserved.

Inland trout streams, headwaters of salmon streams, trout and salmon lakes and the [lower layer, see note 22 infra] of lakes and reservoirs containing salmonids . . . should not be warmed or used for cooling water. No heated effluents should be discharged in the vicinity of spawning areas.

For marine and estuarine organisms, the NTAC recommendations are slightly more complex:

Monthly means of the maximum daily temperatures recorded at the site in question and before the addition of any heat of artificial origin should not be raised by more than 4 [degrees Fahrenheit] during the fall, winter, and spring (September through May), or by more than 1.5 [degrees Fahrenheit] during the summer (June through August). [.] North of Long Island and in the
controlled expansion of industries utilizing water as a coolant will so
damage the ecology of water bodies that they will not be capable of
providing enough food for an expanding population. Electric power,

waters of the Pacific Northwest (north of California), summer limits apply
July through September; and fall, winter, and spring limits apply October
through June. The rate of temperature change should not exceed 1 [degree
Fahrenheit] per hour except when due to natural phenomena.

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WATER QUALITY CRITERIA: RE-
PORT OF THE NATIONAL TECHNICAL ADVISORY COMMITTEE TO THE SECRETARY OF THE IN-
TERIOR, 32-33, 35-36 (1968) [hereinafter cited as NTAC REPORT].

Throughout this paper it shall be necessary to distinguish a temperature and a
temperature increase. A temperature is, e.g., 68 degrees Fahrenheit; a temperature in-
crease is, e.g., 4 Fahrenheit degrees.

Scientists report experimental results in terms of the Centigrade temperature scale. Because there are 100 Centigrade degrees between the temperature at which ice melts and water boils (whereas there are 180 Fahrenheit degrees between the same two points), a Fahrenheit degree is \( \frac{5}{9} \) the size of a Centigrade degree. Because of the difference in sizes of degrees, it is necessary to convert temperatures from one scale to another. Let

\[ F \text{ be the Fahrenheit temperature and } C \text{ the Centigrade temperature. The following for-
rmate make conversions simple:} \]

- (a) to convert Fahrenheit to Centigrade: \( C = \frac{5}{9}(F - 32) \)
- (b) to convert Centigrade to Fahrenheit: \( F = \frac{9}{5}C + 32 \).

3. 1968 Hearings, supra note 2, at 91-96. “There is no doubt that within the next
ten years we will come to realize the extreme importance of fish as a source of protein
food in a world of protein-starved human beings.” Id. at 93 (statement of Trembley).

An estuary is the wide mouth of a river where the current meets the tide.

Estuaries are recognized as being of critical importance in man’s harvest
of economically useful marine resources. It is in these areas that maximum
conversion of solar energy into aquatic plant life takes place and they are
justly identified as nurseries since so many animals utilize them for feeding
their early life stages. *** In sum . . . more than half of the over 4.5 billion
pounds of fishery products harvested by U.S. Fishermen annually is derived
from animals dependent for their existence on clean estuarine waters during
some part or all of their life cycle.

NTAC REPORT, supra note 2, at 67. However, the estuary does not lend itself to estab-
lishing water quality criteria.

The problem in establishing criteria in estuaries arises from the fluctuating
nature of the water quality, both daily and seasonally, and geographically with-
in the estuary. ***

The most obvious effect of tidal action in the estuary is to change water
depth. This indirectly changes current patterns, water temperature, and the
density of motile [capable of or exhibiting spontaneous motion] animal popu-
lations.

In shallow, broad estuaries, wind may be the dominant factor in causing
water movements which change salinity and temperature patterns. The volume
of fresh water discharged into an estuary may be a major factor in establishing
coastal currents that transport pollution loads from one region to another.

We are dealing, then, with an environment in which the characteristics of
the receiving water are fluctuating, frequently unexpectedly. As a result, its
ability to dilute and disperse *** is unpredictable without detailed local
investigations.

Id. As a consequence, it is essential that temperature standards for estuaries be phrased
in numerical temperature elevation limits, such as those proposed by the NTAC, supra
note 2. If numerical standards are not employed, a utility having a choice between an
estuarine site and a river site may prefer the estuarine since environmental opposers are
THERMAL ELECTRIC POWER

one such industry, is expected to double in demand every ten years until 1990. This industry presently accounts for approximately seventy per cent of all heat discarded into the aquatic environment. Of increasing significance is the fact that the electric power industry is moving toward greater use of atomic fuels as heat sources; then saddled with the difficult burden of gathering and presenting evidence of adverse effect. See note 32 infra.

This paper employs the distinction between "standard" and "criteria" used by the National Technical Advisory Committee on Water Quality Criteria:

Standard—a plan that is established by governmental authority as a program for water pollution control.

Criteria—a scientific requirement on which a decision or judgment may be based concerning the suitability of water quality to support a designated use. NTAC REPORT, supra note 2, at vii.


"We have seen estimates ranging from 32 to 256 times increase [in electric power consumption] by 2010 from a 1960 base year." J. Mihursky & L. E. Cronin, Progress and Problems in Thermal Pollution in Maryland 1 (Contribution No. 344, Natural Resources Institute, University of Maryland; presented at the Maryland Water Quality Symposium, December 19, 1967) reprinted in 1968 Hearings, supra note 2, at 136-49.

In 1969 thermal discharges affected only 7 per cent of the total available freshwater runoff in this country; 16 per cent will be affected by 1980 and 50 per cent by 2000 if once-through cooling (pumping cooling water through a power plant's condenser; see note 9 infra and accompanying text) continues. Hearings on H.R. 4148 and Related Bills Before the House Committee on Public Works, 91st Cong., 1st Sess. 387 (1969) [hereinafter cited as 1969 Hearings].

5. DiLuzio, Water Use and Thermal Pollution, POWER ENGINEERING, June 1968, at 44. Almost all of the remaining 30 per cent comes from the steel, paper and pulp, chemical and petroleum industry. Id.

Fortunately, aquatic ecologists prefer to study the ecological impact of thermal discharge in the "outfall" areas around thermal-electric plants because only the temperature of water is different at that point from another similar site a short distance away. Therefore, any change in the two ecosystems results from the plant's thermal discharges. 1968 Hearings, supra note 2, at 102 (Mihursky).

Furthermore, it must be remembered that thermal discharges are synergistic. Consequently, some toxic pollutants are more toxic at higher temperatures and some fish parasites are more destructive at higher temperatures. 1968 Hearings, supra note 2, at 96 (testimony of Trembley). Most chlorinated hydrocarbons, e.g., DDT, chlordane, heptachlor, dieldrin, and aldrin are more toxic to fish in the summer, the principal period of use for agricultural purposes, than in the winter due to higher summer water temperatures. NTAC REPORT, supra note 2, at 67.

Shellfish also demonstrate synergistic effects since they will concentrate copper in their bodies (apparently the copper comes from copper or its alloy in the plant). This is lethal to shellfish and may be lethal to humans that eat the shellfish. 1968 Hearings, supra note 2, at 221 (testimony of R. Green, Commissioner, Maine Dept. of Sea & Shore Fisheries).

6. Although there are now only 14 nuclear plants generating about 2800 megawatts of electricity annually, the Atomic Energy Commission estimates that the equivalent of 700 one-thousand megawatt plants will be operating before the year 2000. 1968 Hearings, supra note 2, at 312 (statement of Senator Muskie); 1969 Hearings, supra note 4, at 414 (statement of J. Ramey, Commissioner, Atomic Energy Commission); OFFICE OF SCIENCE AND TECHNOLOGY, REPORT ON CONSIDERATIONS AFFECTING STEAM POWER PLANT SITE SELECTION 1-5 (1968) reprinted in Joint Committee on Atomic Energy, 91st Cong., 1st Sess., Selected Materials on Environmental Effects of Producing
must not only be larger in order to be economically feasible,7 but they also discharge approximately fifty per cent more heat per kilowatt of electricity produced.8 If thermal discharges adversely affect aquatic ecology, then comprehensive regulation and control is imperative.

This paper analyzes present legal efforts to prevent excessive heat discharges and proposes an administrative apparatus to insure that electric power utilities will foresee and minimize their thermal effects. The author's position is that the ultimate solution is siting power plants where aquatic ecology will be least affected.

I. Heat and Aquatic Ecology

A. Thermal-Electric Power Generation

Electric Power 157-62 (Jt. Comm. Print 1969). The present 14 nuclear plants compare to the more than 300 non-nuclear plants of 100 megawatt size and upwards currently operating, but by 1990 atomic plants, up to 2000 megawatts in size, will supply about one-quarter of the electric power. Id. New atomic plants will occupy 490 new sites of which only 255 have been selected. Id. Among the midwestern areas receiving new atomic plants within the next 10 years are Lake Michigan (5), Lake Erie, Ohio River at Pittsburgh and Cincinnati, and northwestern Indiana. All but 18 states are expected to share in the next 100 nuclear plant sites. California Resources Agency, Report on Siting Thermal Power Plants in California V-3 (1970) (prepared for the Joint Committee on Atomic Development and Space Pursuant to California House Resolution 459).

Electric power plants are usually described in terms of megawatts (one million watts) because the watt and horsepower units are too small for convenience. Since both the watt and horsepower are units of power, it has been shown by experimentation that 746 watts is equivalent to one horsepower. By calculation, it can be shown that a one megawatt plant produces 1,350 horsepower; therefore, a 1000 megawatt plant produces 1,350,000 horsepower. See, e.g., F. Sears & M. Zemansky, University Physics 132 (2d ed. 1955) [hereinafter cited as University Physics].


7. This figure is a compromise. Clark says the value is 60 per cent. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 19; an industrial journal says 67 per cent since, as a rule of thumb, a conventional thermal-electric plant needs 3/4 gallons of cooling water per minute per 1000 watts (kilowatt) generated while a nuclear-electric facility requires 1-1/4 gallons per minute per kilowatt. Electric Utilities Include Built-in Safeguards for Environmental Protection, Environmental Science and Technology, June 1969, at 525; The Federal Water Pollution Control Administration (FWPCA), now the Federal Water Quality Administration (FWQA), says 40 per cent. Address by Deputy Asst' Secretary for Water Pollution Control Jacob I. Bregman, National Symposium on Thermal Pollution, Vanderbilt University, August 14, 1968 [hereinafter cited as Bregman Address]; Maine Yankee Atomic Power and Vermont Yankee Nuclear Power claim that their new plants under construction will discharge only 20 per cent more heat than conventional plants (calculations made by the writer determining the efficiency of each of these plants compared with the 40 per cent efficiency of conventional plants). 1968 Hearings, supra note 2, at 347, 569. Federal Power Commission, Report on Problems in the Disposal of Waste Heat from Steam-Electric Plants 1 (1969); The Federal Power Commission (FPC) staff says 50 per cent based upon the writer's calculations from FPC data. Id. at 1-2.
A thermal-electric power plant utilizes a heat source to generate steam which is then expanded through a turbine to drive a generator that converts heat energy of steam into electricity. The steam is then conveyed from the turbine to pipes in a large chamber where it is condensed into water and recirculated through other pipes back to the heat source to begin the cycle again. Condensation occurs because simultaneously additional water is drawn from a waterbody and flushed through the chamber, thereby cooling the pipes; consequently, steam inside the pipes becomes water. This water, now at a higher temperature is pumped back into the waterbody where it cools. Because this cooling process is slow, it may be miles downstream before normal water temperature is restored.

B. EFFECTS OF EXCESSIVE HEAT IN AN ECOSYSTEM

An ecosystem is a biological community considered as a whole in the context of its environment. Although ecosystems will vary in size, the relationship among the members is one of interdependency.

9. A more detailed description of how thermal-electric power plants operate is contained in 1968 Hearings, supra note 2, at 22-90. For a general discussion of the physics of heat, see, e.g., UNIVERSITY PHYSICS, supra note 6, at 255-354.

10. Conduction is the transmission of heat by the passage of energy from molecule to molecule. UNIVERSITY PHYSICS, supra note 6, at 286. This occurs in the condenser where steam from the turbine transfers its heat to the condenser pipes which in turn transfer heat to the cooling water flowing past the pipes.

11. Jaske, Thermal Discharges Require Advance Planning; 6 INDUSTRIAL WATER ENGINEERING, July 1969, at 18. The equilibration zone below a plant can be approximated by the formula

\[ L = K(\frac{5280}{W})U^{0.8}GW_e \]

where L is the length of the river affected (in miles); W is the average river width; U is the average stream velocity in feet per second; K is a coefficient with a nominal value of four; and GW_e is the plant size in units of thousands of megawatts. Id. When the discharge is going into a lake, the impact area is about 2500-3500 acres (5.5 square miles) for each 1000 megawatts. Id.

12. Clark, Heat Pollution, NATIONAL PARKS MAGAZINE 4, 8 (December 1969) [hereinafter cited as Clark, Heat Pollution]. A more rigorous definition follows:

Ecological relationships are manifested . . . in physico-chemical settings, sets of non-living or abiotic environmental substances and gradients. These include basic inorganic elements and compounds such as water and carbon dioxide, . . . and an array of organic compounds, the by-products of organism activity or death. They also include such physical factors and gradients as moisture, winds, currents, and solar radiation with its concomittants of light and heat. It is against this abiotic backdrop that the biotic components—plants, animals, and microbes—interact in a fundamentally energy-dependent fashion. The abiotic physico-chemical environment and the biotic assemblage of plants, animals, and microbes comprise an ecosystem, in which ecological kinship is demonstrated.

E. KORMONDY, CONCEPTS OF ECOLOGY 1 (1969). The kinships develop from fulfilling requisites for life and reproduction. Id.

13. Thus, the elimination or reduction in numbers of a single species may alter life patterns of hundreds, if not thousands, of others. For example, a member must find a
Thus, any new factor in an ecosystem or a change in an existing factor is likely to alter adversely the status quo. This is especially so in an aquatic ecosystem, given the physiology of cold-blooded animals. Consequently, a temperature increase in a water body resulting from thermal electric discharges may cause one or more of the following disastrous different food source when the population of its typical food is reduced or eliminated. If the member is not as competitive as a second member in obtaining the substitute or if there is not enough of the substitute available for both members (as there almost always will not be since the second member's population is at the optimum size for its food supply), the population of one or both species must decline. But note that this would not be true for these two members if additional heat increases the food supply sufficiently for both species’ needs. Nevertheless, a disruption must occur somewhere in the food chain.

If a species cannot obtain a satisfactory substitute, it will vanish. 1968 Hearings, supra note 2, at 237 (testimony of Donald Mount, Director of National Water Quality Laboratory).

14. As biologists we have learned to equate environmental change with environmental damage. The organization and functioning of the natural environment is a system of great complexity, resulting from millions of years of testing and adjustment of interactions. The interjection of a new factor by man is much more apt to be a monkey-wrench than a beneficial addition. 1968 Hearings, supra note 2, at 285 (testimony of Robert Chute, President, Maine Biologists Association).

An example is presented by the temperature-dependent abundance of three forms of algae—diatoms, green algae and blue-green algae—in the diet of many small animals and larvae. The three forms are found in temperatures ranging from 68-104 degrees F., but their relative abundance varies with temperature. Many organisms in the estuary depend upon diatoms which are more abundant at normal temperatures. As temperature increases the green and then the blue-green algae become abundant; consequently, organisms which can best utilize green and blue-green algae become more abundant while diatom-dependent animals decrease. However, many grazing organisms are not able to digest the blue-green algae; therefore, the number of grazing organisms in the estuary decreases. The decrease causes a decrease in larger animals which feed on the “losers.” This continues on up the food chain until it gets to man. Clark, Heat Pollution, supra note 12, at 7.

Parenthetically, consider also the possible effect of the evaporation of heat into the atmosphere. There is some evidence that the expulsion of carbon dioxide into the air from industrial plants is heating the earth, for the carbon dioxide does not let as much of the earth’s radiation leak into space. Heat discharges may melt the ice caps of the North and South Poles and Greenland. 1968 Hearings, supra note 2, at 113 (testimony of Mihursky).

15. Aquatic animals are cold-blooded and particularly heat sensitive; internal processes function correctly in a limited temperature range. Too little heat means that such an animal’s necessary reactions are too slow for effective activity while too much heat means the animal’s chemistry is reacting too fast to maintain organic integrity. The temperature at which various fish feel too hot or cold varies from species to species and even among different races of the same species. 1968 Hearings, supra note 2, at 236 (testimony of Mount).

Fish are generally subdivided into warm- and cold-water categories. Realizing that the line separating the two is arbitrary, the NTAC appears to have placed it at 68 degrees F., the recommended maximum temperature for growth and migration routes of salmonids, a cold-water species. NTAC REPORT, supra note 2, at 43. The Secretary of Interior has approved 70 degrees F. as the upper limit for a cold-water fishery. Federal Power Commission, Report on Problems in the Disposal of Waste Heat from Steam-Electric Plants 32-34 (1969).
effects upon an aquatic animal: (1) The animal may suffer internal injury leading directly to death, or to uncoordinated movements eventually causing death because of the animals inability to escape its predators or the warmer water;\(^\text{17}\) (2) Starvation may result from the

16. In some circumstances limited additional heat in an ecosystem is beneficial. Wintering fish or those living at the northern geographical extreme of their range are typically being stressed by too little heat; therefore, artificial heat from thermal discharges attracts such animals to the area around thermal-electric power plant outfalls where chemical reaction rates, and thus activity, are more typical of other seasons or geography. The Maine Yankee Atomic Power Company's plant under construction near Wiscasset, Maine, may be beneficial to many of the commercially important species living there at the northern geographic extreme of their tolerance. Furthermore, these animals must endure, as a result of tidal action, temperatures in the 90's on sun-baked mud flats that are then inundated with 60 degree ocean waters. This great range of temperatures will be reduced as a result of thermal discharges. \(^\text{1968 Hearings, supra note 2, at 266-67 (testimony of Dr. J. Ryther, Chairman of the Department of Biology at Woods Hole Oceanographic Institution, acting as adviser to Maine Yankee Atomic Power Company).}\)

As a result of thermal discharges, animals around outfalls may grow faster than usual because their feeding season is lengthened. This may lead to a new food source if present experiments prove that "thermal farming" is commercially feasible. Two saltwater fish, plaice and Dover sole, have grown to market size faster in tests conducted in the effluent of an atomic-electric power plant. Clark, \textit{Heat Pollution, supra note 12, at 7}. Greater food production by weight is also possible by closely regulating temperature. \(^\text{1968 Hearings, supra note 2, at 237 (testimony of Mount).}\) For example, the brown trout consumes more food at temperatures between 50 and 66 degrees F., but its activity is so much greater in this temperature range that a large part of the extra food is needed to maintain body functions. Maximum conversion of food into weight occurs just below and just above this range; therefore, a brown trout hatchery can produce the greatest poundage of brown trout per pound of food consumed by maintaining the temperature just over 66 degrees or just under 50 degrees F. Clark, \textit{Thermal Pollution and Aquatic Life, supra note 1, at 21}.

It is also known that thermal discharges extend the fishing season for certain game fish. \textit{Spore Fishing Institute Bulletin No. 191, January-February 1968, reprinted in 1968 Hearings, supra note 2, at 9}. Two examples are outfall areas on the rivers Patuxent and Potomac in Maryland. \textit{Id.}, at 649.

A plant's thermal discharges may have neither beneficial nor adverse aquatic effects. For example, the Philadelphia Academy of Sciences studied Potomac Electric Power Company's plant at Dickerson on the Potomac River and found that it had caused no substantial harmful change in that river's ecology. \(^\text{1968 Hearings, supra note 2, at 649.}\) Dr. Max Proffitt, Professor of Life Sciences, Indiana State University, and Research Associate at Indiana University, Bloomington, reports that during the first two years of operation at Indianapolis Power & Light's plant near Petersburg no adverse effects have been noticed. M. Proffitt, \textit{Effects of Heated Discharge upon Aquatic Resources of White River at Petersburg, Indiana, February, 1969} (deposited in Water Resources Research Center, Indiana University, Bloomington, Indiana 47401). However Dr. Proffitt notes that in 1970 plant operation and river size has increased and that he is not sure without further study what the present river ecology is. Interview with Dr. Proffitt, April 30, 1970.

17. Additional artificial heat is particularly catastrophic in summer to species living near the southern geographical extreme of their range since these animals are already at their thermal stress limits. When additional heat is added, their chemical reactions produce different, or additional amounts of the usual, by-products which the species' evolved excretory systems cannot eliminate. These by-products result from three physical chemistry forces. First, reaction rates increase with increasing tem-
animal's awkwardness because it will be unable to catch food;\(^{18}\) (3) Starvation may also occur because of the inability of the animal's usual food source to exist in the warmer climate;\(^{19}\) (4) The animal may perish from "thermal shock";\(^{20}\) (5) It may not be able to digest food because of heat induced changes in the cells of the food;\(^{21}\) (6) The animal may be unable to receive sufficient oxygen to function properly;\(^{22}\) (7) The temperature. Clark, *Thermal Pollution and Aquatic Life*, supra note 1, at 20. Second and third, chemical reactions compete with each other producing different products; when the temperature of interacting chemicals is raised, the equilibrium concentrations of the reactions are changed so that the products of those reactions which absorb heat are quantitatively increased. In other words, reacting chemical systems try to offset the effect of temperature increases. See generally W. Moore, *Physical Chemistry* 167-208 (3rd ed. 1962). Consequently, when the by-products of competing reactions absorb heat better than the desired product, the amounts of by-products will be increased because its reaction rate will increase faster than that governing the desired product. These by-products then react with internal organs or among themselves forming new chemicals, many of which the animal cannot eliminate. This process is repetitive and leads to organ dysfunction, internal hemorrhages and erratic and uncoordinated swimming. Clark, *Heat Pollution*, supra note 12, at 4.

18. All species are not affected at the same rate by rising temperatures. A species whose prey has increased relative speed will now have to expend more energy to catch it. For example, tests show that a trout's swimming speed decreases at temperatures "high" to this cold-water fish. At 70 degrees F. it is almost incapable of catching a minnow that it preys upon. Clark, *Thermal Pollution and Aquatic Life*, supra note 1, at 21. Nevertheless, the Secretary has approved 70 degrees F. as an upper limit for cold-water fish in some states. See note 15 supra.

The effect of temperature upon aquatic life need not be so dramatic to be harmful. Temperature influences activity by governing the relative rates of energy demand for performing essential work (e.g., swimming, digesting, courting, capture, escape). For sockeye salmon the maximum sustained swimming speeds at 50 and 66 degrees F. are approximately equal, but because of increased metabolic demand and the elevated level, energy reserves are depleted 1-1/2 to 2 times as fast as the higher temperature. *Natural Resources Institute, Patuxent River Estuary Study with Special Reference to the Effects of Heated Steam Electric Station Condenser Water Upon Estuary Ecology*—(May be obtained from the Natural Resources Institute, University of Maryland, Prince Frederick, Maryland) reprinted in 1968 Hearings, supra note 2, at 150-63.

19. See note 13 supra.

20. Thermal shock—sudden, unexpected temperature increase—results from aquatic life being trapped in condenser cooling water. See text accompanying note 9. Life forms experiencing thermal shock are quite small since larger forms are screened out so that they will not clog condenser pipes. 1968 Hearings, supra note 2, at 671 (testimony of J. Gore, Vice-President of Engineering and Construction, Baltimore Gas & Electric Co.). However, many of these forms are essential to the food chain leading to man and can be up to 95 per cent destroyed passing through the condenser. 1968 Hearings, supra note 2, at 102 (testimony of Mihursky).

A fish kill known to have been the result of thermal discharges occurred during the testing of a new power plant on the Cape Cod Canal. In the summer of 1968 large numbers of menhaden acclimated (living in a temperature long enough to adjust to it) to temperatures in the eighties were thermally shocked to death when they became trapped in plant water at 93 to 95 degrees during the testing of a new power plant. Clark, *Thermal Pollution and Aquatic Life*, supra note 1, at 22.

21. See note 14 supra.

22. Most aquatic species would be able to withstand higher temperatures than they do in fact if it were not for the relationship between temperature and dissolved oxygen.
reproduction of its species may be disrupted or halted completely. In

Oxygen dissolves from air into water inversely with increasing temperature. Hoak, *The Thermal Pollution Problem* (paper presented at the annual meeting of the Pennsylvania Water Pollution Control Association, University Park, Pa., August 10-12, 1960) reprinted in 1968 Hearings, supra note 2, at 73. Since almost all aquatic animals metabolize oxygen, thermal discharges decrease the oxygen available to support life functions.

Fortunately, oxygen dissolves in water at a rate proportional to its absence. *Id.* However, this is not as beneficial as it first seems since hotter water from the thermal discharge rises to the surface because it is less dense. M. Sienko & R. Plane, *Chemistry: Principles and Properties* 154 (2d ed. 1966). Consequently, oxygen in the air does not "know" that there is an oxygen deficiency in lower waters. *Id.* at 93 (testimony of Trembley).

Lack of air below the surface is complicated by the fact that water tends to stratify, i.e., form layers based upon difference in temperature. The top layer has a relatively constant temperature; at about eight feet a second layer forms which has a sharp temperature gradient with increasing depth; the bottom layer has a constant temperature which tends to stay the same year-round (assuming the waterbody is sufficiently deep). 1968 Hearings, supra note 2, at 35-39 (testimony of T. Kolflat, Partner, Sargent & Lundy Engineers, Chicago). A graph experimentally illustrating this phenomenon appears in 1968 Hearings, supra note 2, at 35.

When it gets too hot above, fish move downwards; but then they may metabolize oxygen faster than it is replaced from the surface. The practical result is that thermally stressed aquatic animals are trapped between two conflicting drives: they would prefer to swim down to cool water, but there is less oxygen there; however, by swimming up into hotter water that contains more oxygen, the temperature may increase their activity so much that they may require more oxygen than is gained. Complicating matters even further is the role which oxygen plays in decomposing organic solids in sewage and dead plants and animals. The rates of decomposition of sewage, plants and animals increases as temperature increases and thus the demand for oxygen to accomplish the decomposition increases. *See note 17 supra; Baumann, Physical, Scientific and Engineering Aspects of Pollution, in Water Pollution Control and Abatement 13, 19* (T. Willrich & N. Hines ed. 1967). Also, as temperature increases, algae become more abundant, particularly in the presence of huge quantities of phosphates discharged into waters by phosphate-rich detergents. Since plants (algae) at night use oxygen instead of producing it, there may not be enough oxygen to sustain both the fish and algae, thereby killing more organisms which must consume more oxygen to decay. This is algal bloom, the odiferous stench around many thermally discharging plants. 1968 Hearings, supra note 2, at 95, 110 (testimony of Trembley). *Clark, Heat Pollution, supra note 12 at 7, 8.*

The effect of the oxygen-temperature dependency is particularly brutal to cold-water fish because they simultaneously are more temperature sensitive and more oxygen demanding than warm-water species. *See recommendations of the Committee on Water Quality Criteria in NTAC Report, supra note 2, at 67, where the Committee recommends 40 per cent higher oxygen concentrations for cold-water species.*

23. Spawning is potentially the most dangerous thermal effect from the point of view of expecting the sea to provide food. Many things can go wrong in spawning cycles as a result of excessive heat.

Many aquatic animals depend upon increasing or decreasing temperatures as a signal to swim to their spawning grounds. Rising temperature induces development of gonads and egg deposition. In estuarine shellfish temperature is so important the spawning occurs a few hours after their critical temperature is reached. *Clark, Heat Pollution, supra note 12, at 5. Other animals depend upon the temperature dropping to a certain minimum value before spawning can occur. For example, spawning does not take place in lake trout unless the temperature decreases to 48 degrees F. *Id.* The oppossum shrimp cannot lay eggs in waters above 45 degrees F. *Clark, Thermal Pollution and Aquatic Life, supra note 1, at 22.*
summary, once the critical temperature is reached, the animal will perish if it does not or cannot escape the warmer environment soon. The ramifications are of alarming magnitude since man is at the top of the food chain. Thus, it is imperative that measures be undertaken immediately for practical as well as for aesthetic and recreational reasons.

For those species which spawn when temperature rises to a specific value, artificial heat will cause egg laying sooner than normal. This can mean that youngsters (fry) will be born sooner, possibly at a time when food upon which fry growth depends is not yet available because the food's spawning cycle was dissimilarly affected. While exceptional, some fry are known to be unable to substitute for a certain missing food; these fry won't develop normally. 1968 Hearings, supra note 2, at 237 (testimony of Mount).

Another way in which excessive heat alters reproductive processes results from accelerated chemical reactions in eggs. Atlantic Salmon need 114 days to hatch in 36 degree F. water, but only 90 days in 45 degree water; herring eggs hatch in 47 days at 32 degrees, but need only 9 days at 58 degrees. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 21. Because chemical reactions now occur which could not occur at the lower, typical temperature, see note 17, supra, young may be deformed at birth or not born at all. 1968 Hearings, supra note 2, at 236 (testimony of Mount). Clark, Heat Pollution, supra note 4, at 5. Egg survival temperature ranges are much narrower than any other life history stage. Muhursky & Kennedy, Water Temperature Criteria to Protect Aquatic Life reprinted in 1968 Hearings, supra note 2, at 121. The Oregon River Commission claims that a temperature rise in the Columbia River of only 5.4 degrees F. will be disastrous for the hatchability of Chinook salmon eggs. The banded sunfish fails to develop eggs above 72 degrees; the carp's eggs will not undergo cell division between 68 and 75 degrees; and one tiny crustacean produces only females above 46 degrees. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 21-22.

Finally, thermal effects can devastate a river, narrow bay or estuary for spawning purposes even though only a small portion of it is heated. Thermal discharge quickly spreads across the width of such waterbodies establishing a temperature gradient. When the gradient is steep enough, a thermal barrier forms through which migratory fish will not pass; consequently, they do not reach their spawning grounds. They may then lay eggs in the gradient where it may be too hot, not lay at all, retreat and lay in waters which may not be suitable for their fry's survival, or be heat killed trying to fight through the thermal block. Clark, Heat Pollution, supra note 12, at 8.

Some ecologists are worried about the effect of operation of nuclear-electric power plants now under construction upon the invaluable Chesapeake Bay ecosystem. One company constructing such a plant has commissioned baseline studies of their site; scientists will then be able to determine what effect operation has on the ecosystem.

The company says that it will avoid serious consequences to the bay at any cost, but claims that inasmuch as it is warming only 35 acres of surface water by three degrees F. on the average, no harm will be done. Some scientists studying the bay are not so sure. Their concern is not just that 35 acres of the 2.1 million acre bay might be ruined. Rather they fear that the 35 acre "plume" might spread across the 6 mile waist of the bay near the site, forming a thermal barrier to the passage of surface organisms to spawning grounds in the upper bay. Id.

Obviously, thermal-electric power plants should not be sited in areas where it is known that valuable fishes spawn; yet a comparison of two maps appearing in 1968 Hearings demonstrates that three plants are currently operating and another is planned in areas that are spawning grounds of the striped bass in and near the Chesapeake Bay. 1968 Hearings, supra note 2, at 105-06. The Federal Water Quality Administration has not yet established a recommended spawning temperature limit for this fish. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 24 (graph).

24. See note 3 supra.
II. SUGGESTED REFORMS FOR MINIMIZING THERMAL POLLUTION

Possible legal approaches minimizing thermal pollution include:

25. There are also technological devices which can be utilized to minimize thermal pollution. The key to accomplishing this goal appears to be limiting temperature increases in cooling water as it flows through the condenser. See note 9 supra and accompanying text. Limiting temperature elevation will minimize not only thermal shock, see note 20 supra, but also prevent excessive temperatures in the water body, thereby decreasing possibility of formation of thermal blocks, see note 23 supra, and consequently minimizing spawning problems of migrating fish, Id.

However, technological devices are expensive and may possess undesirable attributes. For example, a typical cooling tower, which would minimize thermal block problems for the 1,000 megawatt thermal-electric plants becoming common, requires at least one structure 300 to 450 feet high possessing a diameter large enough to accommodate a football field in order to cool 400,000 gallons of water pumped through the condenser each minute. FEDERAL POWER COMMISSION, REPORT ON PROBLEMS IN THE DISPOSAL OF WASTE HEAT FROM STEAM-ELECTRIC PLANTS 12 (1969). The Paradise, Kentucky power plant of the Tennessee Valley Authority, presently requires three 437 feet high towers. Id. at 13 (picture).

Almost all cooling towers cool by evaporating heat from water as it is flowing down the cooling tower and are thus called evaporative cooling towers. Such towers present a non-aesthetic problem because they can initiate fogging and icing over areas as large as 160 square miles in cool, wet climates and thereby create driving difficulties during winter and morning hours. A 1,000 megawatt plant ejects about 20,000 gallons of water per minute; this is the equivalent of a daily one-inch rainfall over two square miles. On cold days the evaporated water condenses in the plant's vicinity. Id. at 25. Furthermore, chemicals added to the cooling water in order to retard corrosion in condenser pipes can damage lawns and crops; even greater damage would occur if salt water were the coolant since evaporated salt would destroy vegetation over 160 square miles. Id.

Non-evaporative cooling towers cool by radiation similar to the automobile radiator because cooling water remains in pipes which are exposed to air. However, such towers are larger, three times more expensive and less efficient than evaporative towers. They are also more costly to operate since fans are required to blow away the radiated heat; this means that part of the electricity produced by the plant must be diverted to operate the fans and thus cannot be sold to consumers. OFFICE OF SCIENCE AND TECHNOLOGY, REPORT ON CONSIDERATIONS AFFECTING STEAM POWER PLANT SITE SELECTION 46 (1968) reprinted in JOINT COMMITTEE ON ATOMIC ENERGY, 91ST CONG., 1ST SESS., SELECTED MATERIALS ON ENVIRONMENTAL EFFECTS OF PRODUCING ELECTRIC POWER 201 (Jt. Comm. Print 1969).

Increased cost to the consumer of cooling towers is estimated to be up to 10 per cent greater than without towers for the evaporative type, id., and up to 13 per cent greater for the non-evaporative type, SPORT FISHING INSTITUTE BULLETIN No. 191, January-February 1968, reprinted in 1968 Hearings, supra note 2, at 11. The latter figure is based upon Vermont Yankee Nuclear Corporation's new power plant near Vernon, Vermont, and is disputed by that company; the company claims that the plant, which incorporates towers that can be operated as either evaporative or non-evaporative, will raise consumer costs 15-16 per cent. 1968 Hearings, supra note 2, at 435 (calculations made by the writer from data given the Subcommittee on Air and Water Pollution by Mr. A. Cree, President, Vermont Yankee Nuclear Power Corporation).

Two current devices which appear to possess potential for significantly minimizing thermal pollution are larger intake pumps and mixing equipment at the outfalls. Because temperature rise of water across the condenser is inversely proportional to amount of cooling water, fewer animals would be thermally shocked to death if larger intake pumps flushed more water through the condenser. The drawbacks to this device are added expense of pumping equipment and the fact that it could mean pumping nearly all
the water of some good size rivers and lakes through the plant. For example, Vermont Yankee's 540 megawatt plant now nearing completion would have required, as originally designed, two-thirds of the average minimum daily flow of the Connecticut River. Sport Fishing Institute Bulletin No. 191, supra. This may create undesirable currents or prevent migration; biological effects have been noted four miles away on a small estuary from vigorous pumping. University of Maryland Natural Resources Institute, Special Report No. 1 on Patuxent Thermal Studies, Summary and Recommendations 15, January, 1969.

Mixing devices at the outfalls aid in preventing thermal pollution because heat is transferred from water to air at a rate proportional to the surface area and temperature difference of the water and air; Hoak, The Thermal Pollution Problem (Paper presented at the annual meeting of the Pennsylvania Water Pollution Control Association, University Park, Pa., Aug. 10-12, 1960) reprinted in 1968 Hearings, supra note 2, at 73. But the great disadvantage of such devices is that by the time they act to cool the water, it is too late to save many important microscopic forms from being thermally shocked to death. Nevertheless, mixing equipment in conjunction with larger intake pumps will minimize thermal pollution since they will pump more water through the condenser and disperse it faster upon its return to the waterbody.

It may be possible to reduce thermal discharges with new technologies. Among possible devices which may become commercially feasible electric power sources are nuclear "breeder" reactors, magnetohydrodynamics (MHD), nuclear fusion reactors, geothermal power plants and electrogas dynamic generation.

The "breeder" reactor produces more fuel than it consumes in the process of producing heat and could lead to a reduction in fuel costs since it would produce new fuel two to four times faster than is done by present nuclear reactors. It is hoped that it will be available by 1990. Siting Thermal Power Plants in California, supra note 6, at V-7.

MHD generates power by tapping the energy of conducting fluids moving through magnetic fields and may result in higher efficiencies and thus less heat rejection to waterbodies. Id. at V-8.

Nuclear fusion reactors would permit an almost unlimited fuel supply since we could literally burn rocks. However, a controlled fusion reaction (the Hydrogen bomb is an example of an uncontrolled fusion reaction) has not yet been achieved and it is expected that demonstration plants of this type are about thirty years away. Id. at V-8, V-9.

One geothermal power plant is currently in operation at The Geysers, Sonoma County, California. The plant uses natural steam from within the earth as the energy source for turning turbine blades. Id. at V-4. See text accompanying note 9 supra.

Finally, electrogas dynamic generation is mentioned in congressional hearings on thermal pollution. All heat from it will be converted directly into electricity and thus no heat need be rejected into either air or water. 1968 Hearings, supra note 2, at 113 (testimony of Mihursky). The writer was not able to find out how this technology works. It seems clear that it will be far into the future, if ever, before it becomes commercially feasible.

Another approach to alleviating the thermal discharge problem is to find uses for heated water. The possibility of "thermal farming" of fish has been mentioned, supra note 16, but it is not yet economically feasible. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 23. It would be too expensive to pipe heat to farms for irrigation even if enough remained to significantly improve production; heated effluent is not hot enough to heat buildings. Id. Although it may eventually be possible to improve the efficiency of sewage treatment plants, the most promising idea is to use waste heat in the evaporation process when desalinating sea water. Id.
greater emphasis upon public opinion and the political process, chang-

26. Public opinion has had several spectacular successes in causing alteration or reversal of decisions adverse to the environment, e.g., apparently preventing construction of a jetport in the Florida Everglades and postponing or preventing construction of another dam in the Grand Canyon; however, there is little reason to believe that public opinion is reliable as a continuing force promoting environmental preservation. Success has occurred when the public reaction has reached such cause célèbre proportions that public officials with authority over a project acquiesce for political reasons. However, limitations in this facet of the cause célèbre were vividly illustrated by the Everglades jetport experience. Officials in charge of the project resisted nationwide concern with possible destruction of the Everglades because, as is often the case, it would provide local economic rewards. The project was finally halted by federal officials.

Besides being non-specific, reliance upon the cause célèbre is not practical for other reasons. The initial problem facing a group wanting to create a cause célèbre is projecting their concern through the volume of information competing for the public consciousness. This difficulty is exacerbated by the apparent indifference of large segments of the public to environmental problems. Only a small portion of the public seems aware of the demand our society makes upon the environment; expectedly, the lower and middle classes aren't so concerned because of their problems of making a living. Furthermore, demanding an environmental concern from urbanized persons whose only extended contact with the environment occurs during vacations may be too much to expect. Finally, many of the issues are technically very complex; and, as pointed out by Harold Green:

... the carefully nurtured myth that technical issues are beyond the comprehension of the public... coupled with the corollary proposition that Big Brother knows best and the public should not be unduly alarmed serves to minimize public discussion and debate.


Although this writer does not believe that the public is incapable of informed opinion upon environmental matters—with the risk to be assumed by the public and the benefits it will derive as clearly delineated as possible, the simple question becomes "Where do you want to strike the balance?,” a question democracies have typically handled for years—this writer does not feel that reliance upon public opinion is currently a practical alternative.

27. Professor Harold Green has articulated the difficulties in obtaining legislative action upon environmental problems. Id. at 1-18. Legislatures are political bodies that typically respond to pressures exerted upon them. Environmental disruptors usually have immediate and strong economic interests, are arguably performing a public service, and usually have a well-financed lobby; their opponents seldom represent strong economic interests and are concerned with more subjective social detriments. Since a relatively small percentage of the public feels sufficiently threatened by environmental disruption to exert pressure, disruptors have the upper hand. This is complicated by "the development of an almost obsessive national policy in support of technological advance" at the federal level in the past 25 years. Id. at 7(a).

The primary difficulty is an information gap. Legislators do not have sufficient information to resist benefits pressed upon them by vested interests. The risks of a project, though frequently recognized, are minimized by the following reasoning process.

(1) We do not have enough scientific knowledge to tell us whether or not the risks are really significant, but our best present judgment is that the risks are insignificantly small.

(2) As the project goes forward, further research will be undertaken to verify our judgment that the risks are insignificantly small.
Whatever risks do exist can be reduced to tolerable dimensions through technological devices.

If the risks are indeed found to be, and remain, significant, the program will, of course, be abandoned or drastically restricted or controlled to protect the public interest.

Id. at 9. There are a number of doubtful assumptions in this reasoning scheme, but two are particularly apparent. First, one seldom receives a black-white answer in a multiple variable system; consequently, there always exists adequate room to argue that the observed undesirable result is not the fault of the technology. Secondly, if and when it is shown that the technology initiated the result, it is unreal, in view of vested interests which have arisen with the technology, to expect it to be “drastically restricted or controlled.” Id. An example is the plight of Everglades National Park. During a drought a few years ago, the Park's ecology was so severely disturbed from a lack of fresh water that had been diverted by the Army Corps of Engineers for the benefit of farmers and developers in South Florida that it has not yet recovered. The farmers and developers now want to expand the South Florida water project and the Corps agrees, but it won't guarantee that the Park will receive enough water. Drew, Dam Outrage: The Story of the Army Engineers, 225 ATLANTIC MONTHLY, April 1970, at 59-60.

The information gap presents a more insidious problem to deciding whether the risk is worth the benefits. It is obvious that the benefits of a new technology will appear far sooner than the risks since many of the risks will be cumulative. “An individually acceptable amount of water pollution, added to a tolerable amount of air pollution, added to a bearable amount of noise and congestion, can produce a totally unacceptable health environment.” Green, supra note 26n.3 citing THE REPORT TO THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE BY THE TASK FORCE ON ENVIRONMENTAL HEALTH AND RELATED PROBLEMS, A STRATEGY FOR A LIVABLE ENVIRONMENT 2 (1967). For example, the advantages of chlorinated hydrocarbons as pesticides for increasing agricultural production were immediately obvious, but after more than 30 years use, it was only within the last decade that the dangers of using such chemicals was nationally recognized. See R. CARSON, THE SILENT SPRING (1962). For possible long-term effects of thermal discharges, see notes 13 and 14 supra. Since benefits of technology must appear far sooner than all of the risks, the balance is necessarily shifted in favor of environmental disruption. This writer has no solution for this problem.

The foregoing considerations are persuasive that legislative control over exploitation of the environment is impractical not only because of the present structure of our political system, but also because constant attention to environmental threats is needed. Congress could not give this constant attention even if the present structure were changed to provide a greater voice for environmental interests. The role of legislatures should be to set the minimum standards which society demands from environmental disruptors and delegate enforcement of those standards to a regulatory agency that has an incentive to enforce them. In performing this function, the Congress must weigh all the factors which would influence the minimum standards. The Office of Science and Technology identifies the following 11 “public interest” factors which it recommends be considered in siting power plants:

1. Comply with safety criteria for nuclear plants as prescribed by AEC.
2. Comply with air pollution criteria and standards as established by the States and the National Air Pollution Control Administration of HEW.
3. Comply with water quality standards for thermal effects as established by the States and the [Federal Water Quality Administration] of the Department of the Interior.
4. Develop the opportunities for public recreation at plant sites and avoid impairing existing recreational areas.
5. Consider aesthetic values and give adequate attention to the appearance of power plant facilities and associated transmission lines.
6. Recognize the rural development considerations in plant siting.
7. Consider the siting and lead-time requirements for reliability of service.
8. Consider the impact on defense preparedness of particular sites and power plant capacities.
ing traditional burden of proof rules in private litigation between a utility and persons opposed to a siting decision, and the establishment of effluent water quality standards to replace the present receiving body standards.\textsuperscript{28} However, these reforms, standing alone, are inadequate. A

\begin{enumerate}
\item Consider the routing of associated transmission lines and the problems of rights-of-way at various alternative plant locations.
\item Assure that the plant will be of sufficient size to meet regional needs including mutually agreeable arrangements for meeting the bulk power needs of the small utilities.
\item Consider prospects for combining power plants with other purposes such as desalting plants, industrial centers, and even new cities.
\end{enumerate}

\textit{Office of Science and Technology, Report on Considerations Affecting Steam Power Plant Site Selection VIII (1968) reprinted in Joint Committee on Atomic Energy, 91st Cong., 1st Sess., Selected Materials on Environmental Effects of Producing Electric Power 150 (Jt. Comm. Print).} This writer believes that other factors are equally important, \textit{e.g.}, the possible tendency for pollution control to promote economic concentration, see notes 80-81 \textit{infra} and accompanying text; comparative abundance and cheapness of atomic fuels; decreasing supply of fossil fuels; pressure to consume fossil fuels only for those purposes for which there is not a convenient substitute; expected increase in efficiency of atomic-electric power generation; safety standards; the almost exhausted supply of hydroelectric sites; and new technological developments in power generation, cooling or uses of heated water, see note 25 \textit{infra}.

\textit{28. Two possible approaches in establishing water quality standards are effluent and receiving body standards. Receiving body standards are characterized by concern with the parameters of the waterbody into which heated water is discharged; effluent standards focus upon the parameters of heated water after it leaves the condenser and before it is discharged into the waterbody. Theoretically, since there is a physical relationship between the paramenters of the effluent and that of the waterbody after it receives the effluent, see note 11 \textit{infra}, it does not matter which approach statutes employ. However, the present receiving body standards do not measure characteristics of the waterbody until some mixing occurs; therefore, a certain area in the receiving body is exempt from standards. See, \textit{e.g.}, Maryland Water Resources Commission and Department of Water Resources, State of Maryland Water Resources Regulation 4.8, § 7.60 (1969) which permits 100 degrees F. temperature at 50 feet from the discharge point in shellfish harvesting areas, and New York—300 feet with exceptions—Criteria Governing Thermal Discharges, 6 NYCRR 704.1 (1969) reprinted in New England River Basins Commission, Laws and Procedures of Power Plant Siting in New England: Power and the Environment/Report No. 1 B-3 (1970) \{hereinafter cited as NERBC Report\}. There would be little problem with this approach if we knew what was occurring in the mixing zone and limited its size in some manner designed to insure minimal adverse ecological effect. The NTAC suggests limiting mixing zones in the following manner:}

It is essential that adequate passageways be provided at all times for the movement or drift of the biota. Water quality criteria favorable to the aquatic community must be maintained at all times in these passageways. It is recognized, however, that certain areas of mixing are unavoidable. These create harmfully polluted areas and for this reason it is essential that they be limited in width and length and be provided only for mixing. The passage zone must provide favorable conditions and must be in a continuous stretch bordered by the same bank for a considerable distance to allow safe and adequate passage up and down the stream, reservoir, lake, or estuary for free-floating and drift organisms.

The width of the zone and the volume of flow in it will depend on the character and size of the steam or estuary. Area, depth, and volume of flow must be sufficient to provide a usable and desirable passageway for fish and aquatic
federal regulatory agency with comprehensive siting and enforcement powers is essential in order to insure that new power plant construction reflects need, that the risk of environmental damage will be minimal,\textsuperscript{20} and that the best plant design, balancing all environmental and planning considerations, is chosen. Finally, to guard against abuse of this broad authority, judicial review would focus upon each of these factors.

A. Private Litigation As A Thermal Pollution Control Measure

For those individuals or groups opposed to the siting, construction or operation of a thermal-electric power plant,\textsuperscript{29} there are two methods by which they may obtain judicial consideration of their complaints. Opposers situated on the same watercourse as the utility can use traditional water law principles to seek an injunction against the plant.\textsuperscript{31}

organisms. Further, the cross-sectional area and volume of flow in the passageway will largely determine the percentage of survival of drift organisms. Therefore, the passageway should contain preferably 75 percent of the cross-sectional area and/or volume of flow of the steam or estuary. It is evident that where there are several mixing areas close together they should all be on the same side so the passageway is continuous.

NTAC Report, \textit{supra} note 2, at 31. New York requires the following zone of passage on its estuaries:

The water temperature at the surface of an estuary shall not be raised to more than 90 degrees F. at any point provided . . . at least 50 percent of the cross-sectional area and/or volume of flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge to any stage of tide, shall not be raised to more than 4 Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin or a maximum of 83 degrees F., whichever is less.

Criteria Governing Thermal Discharges, \textit{supra}.

Effluent standards are safer to aquatic life than receiving body standards because they are established in a manner which assures that aquatic life can live in the effluent and thus insure that aquatic life trapped in condenser cooling water does not die from thermal shock, one of the great threats to the food chain. \textit{See} note 20, \textit{supra}. Nevertheless, even with effluent standards zones of passage are necessary to protect aquatic species that have not been screened out of the condenser cooling water by screens installed at intake pumps to prevent large aquatic forms from clogging the condenser's approximately 400 miles of one-inch pipe. Clark, \textit{Thermal Pollution and Aquatic Life}, \textit{supra} note 1, at 23.

29. Rigorously defined, we are not so much interested in whether the risk is acceptable; the focus of concern is whether the risk times the consequences is acceptable. "The chances of being eaten by a leopard on Main Street aren't one in a million, but once is enough." D. Currie, \textit{Federal Courts: Cases and Materials} 17 (1968) \textit{quoting} James Thurber. For convenience, this paper refers to the product of risk times consequences as "risk."

30. Hereinafter referred to as "opposers."

31. The 17 contiguous western states use some form of the prior appropriation doctrine in their water law. This doctrine holds that a person who has used water flowing past his land for a given time period obtains a property right in such water against all future appropriators of water from the stream. I S. Ciracy-Wantrup, W. Hutchins, C. Martz, S. Sato & A. Stone, \textit{Waters and Water Rights} § 18 (R. Clark ed. 1967).
Opposers not so situated must resort to tort law principles of nuisance.\(^\text{82}\)

The remaining states use some form of riparian rights doctrine; under this theory, one does not obtain a property right in water flowing by his land, but receives merely a use of the water. One's use is co-equal with all other users and all are to make reasonable uses of the water in the stream. \(^\text{Id.} \S \text{16.}\)

Consequently, to obtain an injunction against excessive thermal discharges in prior appropriation states, a senior appropriator must show interference with his appropriative rights; in riparian rights states, the plant's discharges must constitute an unreasonable use of the water as to some person. \(^\text{B. GINDLER, Water Pollution and Quality Controls \S 211 (1967) (3 Waters and Water Rights \S 211 (R. Clark ed. 1967)) [hereinafter cited as GINDLER]}\) and cases cited therein.

32. Two branches of nuisance law, public and private, are distinguished. A public nuisance is "the doing of or the failure to do something that injuriously affects the safety, health or morals of the public or works some substantial annoyance, inconvenience or injury to the public." \(^\text{Commonwealth v. South Covington & C. St. R., 181 Ky. 459, 463, 205 S.W. 581, 583 (1918).}\) It is generally held that only a substantial part of the public need be affected. \(^\text{W. PROSSER, HANDBOOK OF THE LAW OF TORTS \S 87 (3rd ed. 1964) [hereinafter cited as PROSSER ON TORTS \S 87.]}\) The common law permitted, until 1535, only public officials to abate such nuisances even where a private plaintiff was asserting an injury different "in kind" from that received by the public. \(^\text{Id. \S 87 citing Y.B. 27 Hen. VII, Mich., pl. 10 (1535).}\) Many states charge state attorneys-general or local public officials with the duty to abate public nuisances. \(^\text{PROSSER ON TORTS \S 89.}\)

Although it is generally accepted that discharge of chemicals which kill fish in streams constitutes a public nuisance, \(^\text{see, e.g., State ex rel Wear v. Springfield Gas & Electric Co., 204 S.W. 942 (Mo. App. 1918) and Hampton v. North Carolina Paper Co., 233 N.C. 555, 27 S.E.2d 538 (1943),\) and \(^\text{generally PROSSER ON TORTS \S 90.}\) Only one case involving heat-killed fish was found; it also declared such killing a public nuisance. \(^\text{In People v. Glen-Colusa Irr. Dist., 127 Cal. App. 30, 15 P.2d 549 (1932), the irrigation district diverted from a river supporting, inter alia, salmon and trout without erecting screens to protect the fish. Some fish in the diverted water were killed when they were unable to find their way back to the river. Salmon fingerlings caught in the diverted water died when the temperature reached 80 degrees as a result of the irrigation process. The court held that this was a public nuisance and enjoined diversion at the request of the Attorney General unless protective screens were installed.}\)

One justification advanced for the rule that only public officials may abate public nuisances is a fear that if anyone affected by the nuisance could seek abatement, courts would be flooded with suits seeking injunctions. \(^\text{PROSSER ON TORTS \S 89.}\) But in conservation cases there is little chance of this happening because of the limited resources of most opposers, even when organized, coupled with the great expense of conducting environmental litigation, \(^\text{i.e., litigation whose purpose is not so much to determine the respective rights of private interests, but rather the rights of the public vis-à-vis a private interest. To litigate effectively, money must be spent to hire men qualified to investigate thermal effects. The Fish & Wildlife Service recommends a two year study before the plant begins operation with the study continuing three or four years afterwards. \(^\text{1968 Hearings, supra note 2, at 279 (testimony of W. Dunham, President, Maine Yankee Atomic Power Co.).\) Fortunately, some tentative conclusions may be possible after one year of operation because some general information is known about some common fish varieties. \(^\text{E.g., see the chart of NTAC's recommended temperature criteria for specific activities of a limited number of fish, NTAC Report, supra note 2, at 33, and a graph of temperature standards for various life stages of 14 fish approved by the Federal Water Quality Administration appearing in Clark, Thermal Pollution and Aquatic Life, supra note 1, at 24. After information is obtained, testimony expenses may run 300-750 dollars per expert per day for a trial that may last weeks. Sive, Securing, Examining and Cross-Examining Expert Witnesses in Environmental Cases 5 (paper presented at the Conference on Law and the Environment, Airlie House,}\)

A cause célèbre is no guarantee that environmental opposers shall be able to meet their financial obligations. For example, although Scenic Hudson Preservation Conference had spent in excess of 250,000 dollars fighting construction of a pumped storage reservoir at Storm King Mountain by Consolidated Edison of New York, Note, Of Birds, Bees and the FPC, 77 YALE L.J. 117, 121 (1967), a Scenic Hudson witness testified at a rehearing that

... there are those who may well think that we can afford to oppose the Storm King project. But that is not the case. At this moment, November 14, 1966, our indebtedness possibly exceeds $100,000. What with the hearings, this indebtedness will vastly increase, without ... any promise that these debts will ever be met.

*Id.* at 120 n.15. The case is still being contested. Thus, to the extent that the "public official only" rule depends upon fear of multiple suits, there is little support for it in conservation litigation.

As another justification for this rule, it can be argued that only public officials should be permitted to bring an action in order to give utilities assurances that its plans meet with official approval. But the growth of "private attorney-general" suits (Judge Frank's term in Associated Industries v. Ickes, 134 F.2d 694 (2d Cir. 1943), *vacated as moot*, 320 U.S. 707 (1943)) permitting attack of agency decisions indicates that courts do not find the approval rationale adequately protecting the public's interest. See, e.g., Scenic Hudson Preservation Conf. v. Federal Power Comm'n, 354 F.2d 608 (2d Cir. 1965) (private conservation group has standing to assert public interest in preservation of beauty of Hudson River and fish therein); Office of Communications of United Church of Christ v. Federal Communications Comm'n, 359 F.2d 994 (D.C. Cir. 1966) (viewers of television station alleged to violate Fairness Doctrine on racial issue had standing to obtain judicial review of commission's renewal of station's license); Scanwell Laboratories v. Thomas, 424 F.2d 859 (D.C. Cir. 1970) (second low bidder has standing to challenge legality of Federal Aviation Administration contract award even though bidder cannot prove that it would have won but for illegal actions alleged); Road Review League, Town of Bedford v. Boyd, 270 F. Supp. 650 (S.D. N.Y. 1967) (non-profit association that reviews highway siting plans of Federal Highway Administration has standing for review under the Administrative Procedure Act even though there is no provision for judicial review under the Federal Highways Act); and Shannon v. Dep't of Housing and Urban Development, 305 F. Supp. 205 (E.D. Pa. 1969) (residents and businessmen have standing to protest an allegedly significant change in the redevelopment of their area from primarily private homes to subsidized public housing rental area). Judicial disillusionment with agency contentions that they are the sole repository of the public interest can be gathered from Judge (now Chief Justice) Burger's rebuke to such a contention in *Office of Communications, supra*:

The theory that the Commission can always effectively represent [the public interest] without the aid and participation of [private citizens] fulfilling the role of private attorney general is one of those assumptions we collectively try to work with so long as they are reasonably adequate. When it becomes clear ... that it is no longer a valid assumption which stands up under the realities of actual experience, neither we nor the Commission can continue to rely upon it.

*Id.* at 1003-04.

Although the justifications for the "public official only" rule do not withstand analysis, no cases were found in the environmental litigation area dispensing with the rule; however, one state by statute permits an individual who believes that the state's attorney general is not enforcing state strip mining laws to mandamus the attorney general to do so. *Ky. Rev. Stats.* 350.250 (Supp. 1968). More of such statutes are needed, but with a much wider scope of environmental concern.

Courts have not been able to hold the line on the public official only rule, but have been compelled to recognize that a private plaintiff should be able to seek abatement when, as to him, the nuisance is a private one or when he is suffering a damage different in kind rather than in degree from that incurred by the public. *Gindler*
In either instance, however, two legal doctrines militate against the likelihood of success by the opposers. First, the threshold inquiry unduly favors the power plant industry. The test, in either a property or nuisance action, is whether the utility's use of the waterbody is reasonable under the circumstances; "reasonable use" is determined by balancing the gravity of the harm caused the opposers against the utility of defendant's activity. In thus balancing the equities, courts consider the relative economic hardship that will result if an injunction is granted or denied, the good faith of each party and the public interest. Because of both the traditional emphasis placed upon industrial development and the increasing demand for thermal-

---

distinguishes these two situations citing Arizona Copper Co. v. Gillespie, 12 Ariz. 190, 100 P. 465 (1909), affirmed 230 U.S. 46 (1913), Bowen v. Wendt, 103 Cal. 236, 37 P. 149 (1894) and Urie v. Franconia Paper Co., 218 A.2d 360 (N.H. 1966) contrasted with Columbia River Fishermen's Protective Union v. City of St. Helens, 160 Ore. 654, 87 P.2d 195 (1939), whereas Prosser appears to lump them together. Compare GINDLER § 220.3 with PROSSER ON TORTS § 89. Prosser devitalizes this exception to the public official only rule by pointing out "the occasional tendency to find a difference in kind where one may at least suspect that only one in degree is really present." Id. Prosser argues that the plaintiff should have an action whenever he suffers substantial harm.

Private nuisance concepts permit opposers to escape the constraints of public nuisance doctrines since the "essence of a private nuisance is an interference with the use and enjoyment of land." PROSSER ON TORTS § 90. Nevertheless, there have been very few private nuisance suits as a result of thermal discharges. This may be because so few uses of water are affected by heat and it is difficult to prove that heat caused the damage. See Sandusky Portland Cement Co. v. Dixon Pure Ice Co., 221 F. 200 (7th Cir. 1915), cert. denied, 283 U.S. 630 (1915) (defendant enjoined from continuing thermal discharges which retarded ice formation in river to an extent that plaintiff's profits shrank); Walker Ice Co. v. American Steel & Wire Co., 185 Mass. 463, 70 N.E. 937 (1904) (manufacturer enjoined from discharging heated water into pond which affected plaintiff's ice business); Mason v. Hill, 110 Eng. Rep. 692 (K.B. 1833) (defendant enjoined from thermally discharging since heated water reduced efficiency of plaintiff's steam engines).

Since it is frequently uncertain whether a private or public nuisance is present when many persons are affected (as would be the typical thermal discharge situation), opposers can avoid public nuisance complexities by pleading as the nominal plaintiff a co-operating landowner adversely affected in the enjoyment of his land by the fact that, for instance, thermal discharges have killed or driven away fish from his land. But since a substantial interference with plaintiff's rights are usually necessary to find a nuisance, PROSSER ON TORTS § 88, opposers must be careful in their choice of nominal plaintiff.

In conclusion, because of the complexities of nuisance doctrines opposers should select, if possible, as plaintiff a person who shares the thermal-electric power plant's watercourse. The question for determination will then be whether the plants discharges are a reasonable use of the watercourse; all the procedural problems of nuisance doctrines will be avoided.

33. Compare PROSSER ON TORTS § 91 with GINDLER § 211.
34. PROSSER ON TORTS § 91.
35. The common law embodied a general preference for the initiator of economically productive action, [sic] by casting the burden of persuasion on an aggrieved person to show cause why law should intervene to shift a loss from where it fell as a consequence of the initiative taken.
electric power, utilities are invariably in a favored position. One possible method to minimize the equity position of the utility is to file a suit for injunction before the utility has expended large sums of money on land and construction. However, this procedure will rarely succeed since plant sites are kept secret as long as possible so as to facilitate land and easement acquisitions at a minimum price.\(^{36}\)

The second obstacle confronting opposers is the legal doctrine governing the allocation of the burden of proof. Preliminarily, it should be noted that opposers face enormous difficulty in obtaining evidentiary data sufficient to establish that a utility's discharge is in fact causing thermal pollution.\(^{37}\) First, as aforementioned,\(^{38}\) a slight temperature in-

---


36. In response to a question on whether his company's ecology consultants were asked their opinion before or after acquisition of a certain site, Mr. Cadwallader stated:

Senator, the problem becomes one of acquisition of a new station site at any cost. If we put it on the street so that everybody knows that we are considering a certain site for a generating station, the site either becomes unavailable or it becomes so expensive that we couldn't afford it.

1968 Hearings, supra note 2, at 684 (statement of L. W. Cadwallader, Vice-President, Potomac Electric Power Co.).

37. A practical definition of pollution is one proposed by the Sport Fishing Institute:

Water pollution is the specific impairment of water quality by agricultural, domestic, or industrial wastes (including thermal and atomic wastes), to a degree that has an adverse effect upon any beneficial use of water yet that does not necessarily create an actual hazard to the public health.


The NTAC's recommended criteria for estuaries are based upon a more stringent definition:

Technically, any foreign substance or environmental condition that interferes with a desired use may be considered a pollutant, but we are concerned with those substances present at high enough concentrations or environmental changes great enough to cause deleterious effect.

NTAC Report, supra note 2, at 67.

Other definitions have been proposed. See, e.g., "resources out of place" in the Bregman Address, note 16 supra. This definition has no utility because it cannot aid in identifying the problem.

It is popularly thought that "thermal pollution" refers to extremely hot water. Much cooler water can also qualify. For example, lethal temperatures of representative fish are Pacific Salmon, Lake Trout, Winter Flounder and Brook Trout—67 degrees F.; Brown Trout—68 degrees; Tautog—86; Greenfish and Silverside—88; Yellow Perch—90; Atlantic Salmon—92; Bluegill and Striped Bass—94; Largemouth Bass—96; Gizzard Shad—97; and Goldfish—107. Clark, Thermal Pollution and Aquatic Life, supra note 1, at 24 (graph).

Furthermore, thermal pollution does not mean that the total annual production of organic material has decreased. For example, 23 fish species are found in the main stream of a small watershed in Pennsylvania while its polluted tributary has only
crease may not have a noticeable affect upon the ecology for a year or longer. Thus, there may be a considerable lapse of time before the general public becomes aware of the disaster. Secondly, considerable amounts of money are needed to adequately investigate thermal effects and ordinarily conservation groups will not have the necessary funds. Finally, opposers would need access to land in the plant's vicinity so as to conduct the necessary testing which means obtaining permission from the landowners, who often may be the utility itself.

The utility, however, is in quite a different position. Not only does the utility necessarily have greater access to factual data, but also it has probably conducted some environmental studies in order to comply with licensing requirements or in anticipation of litigation. Under these circumstances, opposers will seldom succeed since they have the burden of showing that the plant's operation is or will cause ecological damage. An effective remedy, and one which would also provide a workable balance, is to place upon the utility the burden of proving that their thermal discharges will not adversely affect the aquatic environment.

An examination of judicial development illustrates that courts have manipulated the burden of proof rules to promote a result deemed good

three species. The total pounds per acre of fish in either stream is comparable because the three species reproduce without competition from the other 20 species. 1968 Hearings, supra note 2, at 94 (testimony of Trembley).

Some people prefer to speak of thermal nutrition instead of thermal pollution. Thermally polluted waters may produce a larger biomass than natural waters, but it is because of a longer growing season and not due to a difference in nutrition. The augmented biomass, if pollution, is not favorable to man's interests. Id. at 95.

38. See note 23 supra.
39. See note 32 supra.
40. Id.
41. Since passage of the Water Quality Improvement Act of 1970, some studies will be necessary to prove to either the Secretary of the Interior, the state water quality agency, or an interstate commission with jurisdiction over the plant that its discharges will comply with applicable water quality criteria. See Pub. L. 91-224 § 21(b) (1) (April 3, 1970), 84 Stat. 91.

Many firms were conducting advance studies of site ecology. E.g., Maine Yankee Atomic Power Co. began investigating their Wiscasset, Maine, site in 1966 even though their plant will not begin operation until 1972, 1968 Hearings, supra note 2, at 277-78; and Baltimore Gas & Electric Co. has initiated study of its future Bush River site 10 years in advance of projected generation date, Id. at 680 (testimony of Mr. Penn, President, Baltimore Gas & Electric Co.).

42. Illustratively, as the industrial revolution gained momentum and the number of personal injuries to employees increased, it was thought necessary to shield industries against excessive liability; consequently, defendants were often required to plead and prove that they were not contributorily negligent or had not been injured by fellow servants. Krier, supra note 35, at 6 citing Chicago City Ry. v. Leach, 208 Ill. 198, 200-01, 70 N.E. 2d 222 223 (1904) and generally Friedman & Ladinsky, Social Change and the Law of Industrial Accidents, 67 Colum. L. Rev. 50 (1967). As a consequence of the current interest in requiring each enterprise to reflect in the price of its product the costs of production, the burden of pleading and proving contributory negligence is now generally held to
at that time. By similar techniques, courts should shift the burden of proof so as to require thermal dischargers to prove the lack of an unacceptably high risk of significant ecological damage attendant to such discharges. As of yet, this approach has not been adopted, but a recent case, *Texas Eastern Transmission Corp. v. Wildlife Preserves, Inc.*, indicates that at least one state may be moving in this direction.

The primary issue to be resolved was whether plaintiff, Texas Eastern Transmission Corp., arbitrarily exercised its power of eminent domain when it sought to acquire a thirty foot strip through an area of defendant's land devoted to conservation. Whereas plaintiff planned to use the land for an underground gas pipeline, defendant argued that the taking would cause substantial ecological damage. The New Jersey Supreme Court set forth the burden of proof requirements as follows:

[Once defendant] . . . introduces reasonable proof of (1) the serious damage claimed to result from installation of the pipeline on the path chosen by plaintiff, and (2) an apparently reasonably available alternate route . . . , which will avoid the serious damage referred to, the burden of going forward with the evidence will shift to the plaintiff. A *prima facie* case of arbitrariness having been made out, Texas Eastern may present its evidence to the contrary, which it claims indicates that its location of the right of way selected represented a reasonable and not a capricious choice . . . .

---


44. *Wildlife Preserves*, situated only 20 miles from Times Square, was called by two of its experts "the finest inland, natural freshwater wetland in the entire Northeastern United States." 48 N.J. at 270, 225 A.2d at 135.

45. 48 N.J. at 275-76, 225 A.2d at 138. Furthermore, the court held that: . . . the quantum of proof required of this defendant to show arbitrariness against it should not be as substantial as that to be assumed by the ordinary property owner who devotes his land to conventional uses.

48 N.J. at 273, 225 A.2d at 138.
Even though the burden of proof still rests upon the opposers, the case is significant to the extent that it forces a utility to consider the likelihood of environmental damage when it is exploring possible plant locations. Prior planning, based in part upon ecological risk, should increase the chances for finding acceptable solutions or compromises between utilities and conservation groups.

Nevertheless, in view of the increasing numbers of organizations possessing the power of eminent domain and the heightening need to protect our environment from severe disruptions by groups that are typically sheltered from public scrutiny and control, the decision does not go far enough. First, instead of placing upon opposers the burden of showing ecological damage, as the court did, the utility should have the obligation to show that its activity will not cause unreasonable environmental disruption. As stated previously, this redistribution of the burden of proof is justified because of the utility's accessibility to information and its greater ability to plan. Secondly, it is inappropriate to place upon opposers the duty of showing "an apparently reasonably available alternative route"; the utility should bear this burden also because it certainly has greater knowledge and experience in siting thermal-electric power plants.

The case of Scenic Hudson Preservation Conference v. Federal Power Commission went farther than Wildlife Preserves because it did not shift the burdens of proof; rather it requires exploration of alternatives by the FPC. The FPC had granted Consolidated Edison Company of New York, Inc. a permit to construct the world's largest pumped storage plant at Storm King Mountain. Transmission lines were to run under the Hudson River and then underground about two miles to a switching station to be built. From there, overhead lines would run for twenty-five miles into the city. The court of appeals remanded, holding that the record did not support the FPC decision because it

46. There are 181 “major” electric power companies in the U.S., Wall Street Journal, Mar. 23, 1970, at 1, col. 1, plus gas transmission companies telephone companies, and state highway siting agencies. All typically can exercise the eminent domain power. This is only a partial listing; see e.g., Contemporary Studies Project: New Perspectives on Iowa Eminent Domain, 54 Iowa L. Rev. 736, 738 n.6 (1968) [hereinafter cited as Iowa Eminent Domain] for a compilation of organizations possessing eminent domain powers in Iowa.
47. See text following footnotes 45 and 41 supra.
48. 48 N.J. at 275, 225 A.2d at 138.
49. 354 F.2d 608 (2d Cir. 1965) [hereinafter referred to as Scenic Hudson].
50. Pumped storage power plants generate electricity by pumping water uphill and storing it during slack periods of power demand. When the peak demand periods during the day and early evening require more power than can be supplied by other plants, water is run downhill through turbines that turn electrical generators.
ignored some relevant factors and "failed to make a thorough study of possible alternatives to the Storm King Project."

In summary, if courts shift the burden of proof on the issues of ecological damage and reasonable alternative siting from opposers to utilities, then courts can be an effective instrument in minimizing the environmental impact of thermal-electric power plants. However, the ultimate solution in the area of thermal-electric pollution must come from the legislative branch of government in the form of statutes establishing constraints upon temperature elevation and in the creation of one federal agency with comprehensive siting and enforcement powers.

B. WATER QUALITY STANDARDS AS A THERMAL POLLUTION CONTROL MEASURE

The primary goal of the Federal Water Pollution Control Act is to enhance the water quality of the United States. Water quality standards can aid in the achievement of this goal in three ways. First, the standards should be non-degradation standards. This means that the existing quality of water in an area shall not be lowered when standards are enacted. Although the Act does not explicitly grant the Secretary of Interior the authority to take this position, he has done so. Secondly,

51. 354 F.2d at 612.
52. See note 27 supra arguing that Congress cannot oversee the electric power industry, but it should weigh all factors involved in the industry's growth and express its judgment upon the best direction of that growth through water, air and safety standards.
A federal agency with comprehensive siting and enforcement powers is proposed in the text accompanying notes 147-51 infra.
53. "The purpose of [the Federal Water Pollution Control Act] is to enhance the water quality and value of our water resources and to establish a national policy for the prevention, control, and abatement of water pollution." 33 U.S.C.A. § 466(a) (1964).
54. There is a fourth way to enhance our water quality. If less heat is discharged into water, temperature will be lower. One way to lessen future thermal discharges is to slow down the steady increase in per capita consumption of electricity. CALIF. RESOURCES AGENCY, SITING THERMAL POWER PLANTS IN CALIFORNIA 1-2 (1970) (report prepared for the Joint Committee on Atomic Development and Space of the California legislature pursuant to House Resolution 459). This could be accomplished by banning advertising by electric power companies, by denying an expense deduction for such advertising and/or by refusing to consider advertising expenditures in setting a rate base. Decreased demand for electric power would also mean a decrease in air pollution as a result of fossil fuel plants needing to burn less fuel; if the power plant is atomic, there would be less radioactive material to be discharged into water or buried in underground vaults.
Whether to utilize any of these approaches is a legislative question since a decrease in electric consumption could mean, if the public does not decrease its power demands, utilizing one or more other fuels for energy. These fuels may soon be in such short supply that their consumption should be restricted to those uses for which there are no reasonable substitutes.
55. Letter from Secretary of Interior Stewart Udall to Congressman John D.
the number of recognized water quality categories can be reduced or
the water quality standards raised. The Federal Power Commission
states that at least seven "major" temperature categories are currently
recognized, with the lowest quality applicable to industrial use waters.\textsuperscript{56} By eliminating the lowermost category in stages of every five years
until the minimal acceptable quality would be that presently designated
"recreational," this country's water quality can be gradually and signi-
ficantly raised. Lastly, since many states grant industries a permit which
allows them to violate water quality standards otherwise applicable,\textsuperscript{57}
an effective way to enhance water quality would be to condition renewal
of these "pollution" permits upon the construction of facilities adequate
to meet at least recreational use standards.

Even though the federal Water Quality Act of 1965 envisioned
water quality standards by June, 1967,\textsuperscript{58} almost one-half of the states
presently do not have approved temperature and dissolved oxygen
standards.\textsuperscript{59} This is true despite the fact that the Secretary of Interior
has authority under the Act to promulgate standards for delinquent states.\textsuperscript{60} Because the process of establishing water quality standards is

\begin{itemize}
\item Dingell, Oct. 6, 1967, on file in Indiana University School of Law Library under title
  "Determination of Beneficial Use Is Integral Part of Setting Water Quality Standards;"
  No. M-36722.
\item 56. The categories are Cold-water fish, Smallmouth bass, Warm-water fish,
  Fish & Shellfish, Recreation, Water Supply and Industrial. Some states have dis-
  tinguished between fresh and marine waters; Two states preserve natural waters and
  some distinguish between different classes of aquatic life in a category. Federal
  Power Commission, Report on Problems in Disposal of Waste Heat from
\item 57. Ohio's Congressman Vanik has pointed out that the number of permits to
  pollute granted annually in his state has decreased only nine in a recent four year
  period before 1968. 1969 Hearings, supra note 4, at 76. However, Reitze of Case
  Western Reserve points out that this may not be the significant point; it may be more
  important to require all polluters to obtain a permit and raise the standards required
  for renewal each year. Conversation with Reitze, Bloomington, Indiana, April, 1970.
  This is simply a withdrawal of the permit at a slower rate.
\item 58. 33 U.S.C. § 466g(c) (1) (Supp. IV, 1970).
\item 59. 33 U.S.C. § 466g(c) (1) (Supp. IV, 1970). The states that do not have complete
  approval of their temperature standards are Alabama, California, Colorado, Florida,
  Illinois, Iowa, Kansas, Maine, Michigan, Mississippi, New Hampshire, New Jersey,
  North Carolina, North Dakota, Ohio, Oregon, South Carolina, Tennessee, and Virginia.
  Federal Water Pollution Control Administration, Water Quality Standards Summary
  Temperature Criteria, January, 1970 (obtainable from FWPCA office, Washington,
  D.C.).
\item Sixteen states do not have approved minimum dissolved oxygen standards. These
  states are Alabama, Connecticut, Delaware, Illinois, Kentucky, Maine, Louisiana,
  Mississippi, Missouri, New Jersey, North Carolina, Oklahoma, Rhode Island, South
  Carolina, Vermont and Virginia. Federal Water Pollution Control Administration,
  Water Quality Standards Summary Dissolved Oxygen Criteria (Minimum), February,
\item 60. Instead of the Secretary unilaterally promulgating standards, the states and
  the Federal Water Quality Administration negotiate differences between a state's
\end{itemize}
complex, this writer has been unable to determine the minimum standards which the Secretary will approve. However, assuming that public policy should be to sanction only reasonably necessary ecological risks, the following factors are important in establishing standards.

Approved standards should closely follow those recommended by the National Technical Advisory Committee on Water Quality Criteria, a group of ecologists employed by the FWQA to undertake a comprehensive study of aquatic ecology, because this Committee formulated recommendations based upon the public policy doctrine mentioned above. Furthermore, uniform standards should be established for proposed standards and the agency's minimum expectations. Although this procedure is also permissible by the statute, 33 U.S.C. § 466g(c)(2) (Supp. IV, 1970), it is submitted that it is being abused since three years have elapsed since the deadline Congress anticipated.

61. The complexity of establishing temperature standards is indicated by the fact that the NTAC, although it made recommendations upon such standards as dissolved materials, carbon dioxide concentrations, oil, turbidity, settleable materials, color and transparency, floating materials, tainting substances, salinity, currents and toxic substances, spent more time on temperature standards than all other standards combined.

62. It is at least arguable that the Environmental Quality Improvement Act of 1970, Pub. L. No. 91-224 (April 3, 1970), 84 Stat. 91, supports the proposition that this is public policy. Section 202 reads:

(a) The Congress finds—

(1) that man has caused changes in the environment;
(2) that many of these changes may affect the relationship between man and his environment; and
(3) that population increases and urban concentration contribute directly to pollution and the degradation of our environment.

(b) (1) The Congress declares that there is a national policy for the environment which provides for the enhancement of environmental quality....

63. The first National Technical Advisory Commission on Water Quality Criteria (NTAC) to the Federal Water Pollution Control Administration was created by the Secretary of Interior in order to aid the Secretary's compliance with provisions of the Water Quality Act of 1965, 33 U.S.C. § 466g(c) (Supp. IV, 1970), that require the Secretary to approve water quality standards established by the states if the standards are such "as to protect the public health or welfare, enhance the quality of water and serve the purposes of this Act." Id. § (c) (3). The NTAC's full report has been published. NTAC Report, supra note 2.

64. E.g., the NTAC's recommended temperature criteria for estuarine and marine organisms include this caveat:

The committee would like to stress the fact that, due to a lack of fundamental information on the [dissolved oxygen] requirements of marine and estuarine organisms, these [temperature] requirements are tentative and should be changed when additional data indicate that they are inadequate. NTAC Report, supra note 2, at 70. Furthermore, we are concerned with those substances present at high enough concentrations or environmental changes great enough to cause deleterious effects. Id. at 67.
aquatic areas throughout the country which are designated for identical
uses. Although this has yet to be done,\textsuperscript{65} those states presently establishing standards should be required to duplicate those of states which share a common water boundary. This would remove pressure upon a state to sacrifice its water quality in order to attract industry,\textsuperscript{68} and it would also eliminate jurisdictional disputes resulting from a plant meeting the discharge standards of one state but violating the standards of another which shared a common water body.\textsuperscript{67}

Standards should also be approved which define maximum temperature limits. Without such, a period of high temperatures can destroy all that is to be gained by establishing standards.\textsuperscript{68} Consequently, limits

\begin{itemize}
\item\textsuperscript{65} The Connecticut River flows through or by Connecticut, Massachusetts, New Hampshire and Vermont. Connecticut has approved standards of 85 degrees Fahrenheit for all waters: New Hampshire's industrial use water is approved for 90 degrees. Massachusetts' standards are 88 degrees for cold-water fisheries, 83 degrees for warm-water fisheries and 90 degrees for industrial use waters; Vermont has identical values in its standards. Confusing the problem even more, New Hampshire does not have approved standards for many categories. \textit{Federal Power Commission, Report on Problems in the Disposal of Waste Heat from Steam-Electric Plants} 32-34 (1969).
\item\textsuperscript{66} Industry tends to seek a stable power source; consequently, they will locate near available supplies of electric power. The electric power industry and Congress have recognized this effect for some time according to an official of the Potomac Electric Power Company. He testified before the Senate Subcommittee on Air and Water Pollution that  
\begin{quote}
... it was determined by the Senate subcommittee hearing conducted in 1955 that while [Potomac Electric] would not necessarily damage the river ...\that if we built there that we would attract industry to that area, and they would pollute the river.
\end{quote}
\textit{1968 Hearings, supra} note 2, at 683. (testimony of Vice-President, Generating, Potomac Electric Power Co.).
Siting by electric power companies is influenced by expense. Whenever differing standards between two states can produce a savings it can be expected that the plant will be sited in the "cheaper" state. Of course, this factor can be important only when the cost of additional transmission lines and relay stations is less than the cost of cooling equipment; this criteria can be met by utilities who service more than one state or who are situated near state boundaries. \textit{See, e.g., note 65 supra}, where differing standards in Connecticut, New Hampshire and Vermont may have influenced Vermont Yankee Nuclear Power Corporation to site near Vernon, Vermont, only three miles north of Connecticut and across the Connecticut River from New Hampshire.
\item\textsuperscript{67} \textit{See text accompanying notes 89-91 infra.}
\item\textsuperscript{68} Certain misconceptions and miswordings have arisen due to the increasing interest in and misunderstanding of the effects of thermal loading of waters. An example is the use of averages in the establishment of rules for water use; the average dissolved oxygen concentration must not go below 5 [parts per million]; the average temperature of receiving waters must not exceed 90 [degrees] F., et cetera. Living organisms in a stress environment are not interested in averages, but in maxima and minima. A fish that is heat killed over a period of 5 minutes' exposure to high temperature is quite as dead as one exposed to high temperature over a 5-day period.
\textit{1968 Hearings, supra} note 2, at 95 (statement of Tremblay).
\end{itemize}
in temperature elevation in the condenser are required in order to protect aquatic life, but no state imposes such limits. The NTAC recommended that the size of the permissible mixing zones be based upon ecological considerations rather than keyed to the physics of cooling water. This approach is an excellent means to effectuate the public policy of permitting only reasonably necessary ecological risks. Several states follow this doctrine and thus do not permit a mixing zone when there is unacceptable risk of adverse ecological effect. However, other states maintain that a mixing zone must be permitted. The Federal Water Pollution Control Act is silent on this point. Finally, industries should not be granted a prolonged period of

69. See notes 20 and 28 supra.
70. University of Maryland's Natural Resources Institute proposed limiting temperature increases in the condenser, see NATURAL RESOURCES INSTITUTE, INTERIM RECOMMENDED REGULATIONS FOR STEAM ELECTRIC STATIONS IN MARYLAND 1 (1968) reprinted in 1968 Hearings, supra note 2, at 166, but the final standards do not contain this feature. See State of Maryland Water Resources Regulation 4.8, General Water Quality Criteria and Specific Water Quality Standards for all Maryland Waters (April, 1969) (obtainable from Water Resources Commission, State Office Building, Annapolis, Maryland 21401).
71. From the standpoint of the welfare of the aquatic life resource, . . . such areas should be as small as possible and be provided for mixing only. Mixing should be accomplished as quickly as possible through the use of devices which insure that the waste is mixed with the allocated dilution of water in the smallest possible area. [emphasis added] NTAC REPORT, supra note 11, at 31.
72. See note 62 supra.
73. Massachusetts does not permit mixing zones, but does permit a 4 degree F. increase at the point of discharge. 1968 Hearings, supra note 2, at 345. Maryland requires the Department of Game and Fish to establish the size of the mixing zone which "is necessary for the protection of the water use"; this may mean that its zones may be non-existent if that department so determines. MARYLAND WATER RESOURCES COMMISSION AND DEPT. OF WATER RESOURCES, STATE OF MARYLAND WATER RESOURCES REGULATION 4.8, § 7.60 (1969).
74. Florida is one example. 1968 Hearings, supra note 2, at 742. Other states having mixing zones are, e.g., New York—300 feet with exceptions—Criteria Governing Thermal Discharges, 6 NYCRR 704.1 (1969) and Maryland—100 degrees F. maximum at 50 feet in shellfish harvesting category, supra note 73.
grace before standards become enforceable, particularly in the northern
states' cold-water fisheries during the migration season.\textsuperscript{76} This should
also apply to the southern states' warm-water fisheries and to shellfish
propagation areas since heat additions will further stress species existing
in water bodies marginally capable of supporting them.\textsuperscript{77}

A number of problems accompany the idea of raising water quality.
In addition to the enforcement difficulties resulting from understaffed,
poorly paid and inadequately trained state personnel,\textsuperscript{78} a major obstacle
is that many thermal dischargers would be forced to cease operation if
installation of new equipment is required.\textsuperscript{79} Consequently, methods of
minimizing this economic hardship are needed.\textsuperscript{80} One possible method
may be found in the area of federal tax law. Congress has enacted
provisions similar to the accelerated write-offs permitted for emergency
facilities.\textsuperscript{81} However, Congress should have made qualifying for the
write-off conditional upon plant discharges meeting recreational stand-
ards. Plants that could not meet this standard would amortize on a
straight-line basis their investments in pollution abatement equipment
that would meet otherwise applicable water quality standards. Thus, a
plant choosing between two sets of pollution abating equipment, each
having an expected useful life of twenty-five years, would most likely
purchase the equipment that would meet recreational water standards
since the investment could be amortized five times as fast. This technique

\textsuperscript{76} One fish kill known to have been caused by thermal discharges occurred during
the testing of a new power plant on the Cape Cod Canal. There in the summer of
1968, large numbers of menhaden acclimated to temperatures in the 80's were thermally
shocked to death when they became trapped in effluent water at 93 to 95 degrees F.
during the testing of a new plant. Clark, \textit{Thermal Pollution and Aquatic Life}, supra
note 1, at 22. See also text accompanying notes 101-03 infra.

\textsuperscript{77} The effect of heat additions is to replace biota with species more typical of
southerly species. This is particularly crucial in this country since, except for some
southern species, "our" fish cannot live in waters with temperatures in excess of 93
degrees. Clark, \textit{Thermal Pollution and Aquatic Life}, supra note 1, at 19-20.

\textsuperscript{78} Cf. Iowa Eminent Domain, supra note 46, at 774. NERBC Report, supra
note 28, at 79.

\textsuperscript{79} Some firms, especially small ones, can be driven out of business. This
tendency for environmental control to encourage monopoly or at least favor
large industries is worthy of separate study. Nevertheless, we do not favor
murderers or robbers merely because they are impecunious. To allow
the destruction of our environment by those who claim poverty would be absurd.
Reitze, \textit{Wastes, Water, and Wishful Thinking: The Battle of Lake Erie}, 20 Case
W. Res. L. Rev. 5, 28 (1968).

\textsuperscript{80} Reitze has proposed that the company purchasing pollution control equip-
ment be able to write off the entire cost in one year as a business expense. \textit{Id. at 74-}
75. But this seems to pay the polluter to stop doing something which he has no "right"

to do.

\textsuperscript{81} Int. Rev. Code of 1954, § 169, added by Pub. L. 91-172, Title VII, § 704(a)
would have the further advantages of possibly minimizing economic concentration while also providing much needed recreational facilities near cities.

C. TWO RECENT STATUTES AS THERMAL POLLUTION CONTROL MEASURES

Aspects of Federal Law Respecting Thermal Discharge

Because of uncertainty over whether the Federal Water Pollution Control Act encompassed thermal discharges,82 Congress amended it with the Water Quality Improvement Act of 1970.83 The WQIA provides that a federal license or permit, authorizing any plant whose activity may result in discharge into navigable waters, is conditional upon certification by the state in which the discharge originates that there is reasonable assurance the discharge will not violate the state's water quality standards.84 The Act further states that if a plant’s discharge may “affect the water quality of another state, the licensing agency is to hold a hearing and condition the license in a manner “necessary to insure compliance”85 with that state’s water quality standards. Additionally, the Act provides for termination or suspension of a license if standards are violated.

The first obvious improvement made by the WQIA is that it seeks to regulate thermal discharge.86 However, since thermal pollution will not be satisfactorily controlled until all states have temperature standards, the Secretary of Interior should exercise his authority and establish water quality standards for the nineteen delinquent states.88 A second

---

82. The uncertainty arose over the use of the word “matter” in defining pollution. 33 U.S.C. § 466g(a) (1964). It was felt that courts might not think that Congress meant to include heat within the term.
84. Any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters of the United States, shall provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate . . . that there is reasonable assurance, as determined by the State . . . [,] that such activity will be conducted in a manner which will not violate applicable water quality standards.
Pub. L. 91-224, § 21(b)(1).
85. Id.
86. Id.
87. “Any applicant . . . to conduct any activity . . . which may result in any discharge into the navigable waters. . . .” Id. [emphasis added]. Cf. note 82 supra.
88. See note 59 supra.
improvement made by the 1970 amendment is that it prohibits federal agencies from granting licenses before the state certifies compliance with its water quality standards. This change should eliminate some of the pressure that was typically exerted by an industry on a state agency; no longer armed with a federal license, an industry's argument that the agency is being intentionally obstructive to a satisfactory plant loses its impact.

Furthermore, the WQIA eliminates the kind of jurisdictional dispute involved in State of New Hampshire v. Atomic Energy Commission. In this case, the Vermont Yankee Nuclear Power Corporation obtained approval from the state of Vermont to build and operate a plant in Vermont. However, the utility refused to submit to New Hampshire jurisdiction even though the latter owned the Connecticut River into which the plant would discharge. New Hampshire then attempted to obtain AEC jurisdiction on the thermal effects issue, but the AEC denied jurisdiction and this determination was upheld by the First Circuit. In order to avoid similar problems in the future, the WQIA requires the federal licensing agency to hear jurisdictional disputes and condition its granting of a license in such a manner as will "insure compliance" with the complaining state's standards.

A fourth improvement provided by the amendment is that a utility need obtain state certification of compliance with applicable standards only once. The certification, obtained just prior to construction, remains valid unless changes have occurred in construction or operation of the plant, water quality standards, or "the characteristics of the waters" receiving the discharge so as to no longer provide "reasonable assurance" of compliance. This procedure contrasts with that of the AEC which requires agency approval before both construction and operation.

Even with the 1965 Act and the 1970 amendment, there are several significant shortcomings in present federal law with respect to the control

---

89. 406 F.2d 170 (1st Cir. 1969).
90. As of March 10, 1970, the utility still had not submitted to the jurisdiction of New Hampshire. Letter from New Hampshire's Assistant Attorney General, R. Peter Shapiro, to author, March 10, 1970, on file in Indiana University School of Law library.
92. Pub. L. 91-224, § 21(b) (2).
93. Id. § 21(b) (3).
94. Id.
and prevention of thermal pollution. First, the federal government has failed to establish temperature limits in the condenser. Consequently, many aquatic animals will die of thermal shock before they reach the regulated waterbody, effluent standards would prevent this from occurring. Ambiguity in section 10(h) of the FWPC Act is a second shortcoming of federal law. The section provides that in an abatement suit, the court:

... giving due consideration to the practicability and to the physical and economic feasibility of complying with such standards, shall have jurisdiction to enter such judgment and orders enforcing such judgment as the public interest and the equities of the case may require.

Thus, the section does not explicitly include as a factor to be weighed in abatement suits the ecological impact of violating the standards. Consequently, if courts view section 10(h) as a statutory codification of the balancing of the equities test used in nuisance and riparian law, abatement of thermal pollution will be virtually nonexistent.

Federal law is also inadequate because it fails to provide for speedy resolution of disputes involving the impact of thermal discharges. For example, suppose that on a river marginally capable of supporting a migratory species, a thermal-electric power plant begins operation several months before the species' annual spawning run. If the utility reasonably believes a court would permit it to discharge at temperatures in excess of the species' tolerance on the grounds that the plant could not otherwise physically or economically operate, one year-crop of the species would be lost since the Secretary of Interior could not bring an abatement suit until the plant was in operation six months. In those situations where a plant intends to install pollution control equipment, the six month period granted to it for that purpose may be reasonable. However, this period of grace is totally unjustifiable when the ecological damage is likely to be severe, and when the utility has no intention of controlling its thermal discharge.

96. See note 20 supra.
97. See note 28 supra.
99. Id.
100. See text accompanying note 34 supra.
101. This hypothetical is not far-fetched. For instance, the Florida Light & Power Company refused to halt construction of a cooling canal for an addition to its Turkey Point power plant even though the government contended that the discharges would harm the ecology of the estuary into which the canal would discharge.
103. See note 77 supra.
An additional inadequacy in present federal law will emerge if the Second Circuit Court of Appeals' treatment of the standing issue in *Citizens Committee for the Hudson Valley v. Volpe* is not followed by

104. 425 F.2d 97 (2d Cir. 1970). The state of New York needed a permit from the Army Corps of Engineers authorizing dredging and filling part of the Hudson River in order to build a segment of a six lane highway partially in the Hudson. The Village of Tarrytown, a chapter of the Sierra Club and the Citizens Committee for the Hudson Valley, a previously non-existent group which organized solely to fight this project, opposed issuance of the permit, but the Corps issued it pursuant to the authority in § 9 of the Rivers and Harbors Act of 1899, 33 U.S.C. § 403 (1964), which commits some shoreline construction to the Corps' discretion. The plaintiffs argued that the proposed structures would be a "dike" and a "causeway" within the meaning of 33 U.S.C. § 401, two structures which the Corps must submit to Congress for approval, and sought both a declaration that the permit was beyond the scope of the Corps' authority, and an injunction against issuance of the permit without congressional approval and Secretary of Transportation consent.

Before the court could consider the standing issue, it had to decide whether the lack of provision for judicial review in the Rivers and Harbors Act deprived it of jurisdiction. In affirming the district court's granting of plaintiff's requests, 302 F. Supp. 1083 (S.D.N.Y. 1969), the court found both jurisdiction and standing in two provisions of the Administrative Procedure Act (APA). Jurisdiction was found under 5 U.S.C. § 704 (1964), which provides that:

... agency action made reviewable by statute and final agency action for which there is no other adequate remedy in a court are subject to judicial review.

Standing was found under 5 U.S.C. § 702 (1964), which provides that:

... a person suffering legal wrong because of agency action within the meaning of a relevant statute, is entitled to judicial review thereof.

The court held that the presumption of reviewability under the APA which the Supreme Court announced in *Abbott Laboratories v. Gardner*, 387 U.S. 136 (1967), conferred equitable jurisdiction upon the court to protect any rights which the plaintiffs might have. Jurisdiction was founded upon the practical ground that "if the Administrative Procedure Act could not itself serve as a basis for jurisdiction, the important goal of subjecting final agency action to judicial scrutiny would be frustrated." 425 F.2d at 102.

Turning to the standing issue confronting Citizens Committee and Sierra Club, the court quoted the recent D.C. Circuit opinion in *Office of Communications of United Church of Christ v. FCC*, 354 F.2d 994 (D.C. Cir. 1966), to the effect that standing was also a "... practical and functional [concept] designed to insure that only those with a genuine and legitimate interest can participate in a proceeding. ..." 425 F.2d at 103.

That the plaintiffs possessed standing to seek judicial review was not yet assured since the Supreme Court recently held that in addition to an adversary interest, "there must be some connection between the official action challenged and some legally protected interest of the challenger." *Jenkins v. McKeithen*, 395 U.S. 411, 423 (1969). The Second Circuit said that the groups' activities and conduct (organizing to express concern with the use to be made of natural resources and willingness to finance intervention) indicated their special interest. It then held that "aggrieved" in the APA meant the same as in the Federal Power Act or any other act; that if "aggrieved" conservationists had standing under the Federal Power Act, 16 U.S.C. § 825l(a) (1964), these conservationists are aggrieved within the meaning of at least three Acts: Federal Power Act, 16 U.S.C. § 825l(b) (1964), Department of Transportation Act of 1966, 49 U.S.C. § 1653(f) (Supp. IV, 1970), and the Administrative Procedure Act, 5 U.S.C. § 702 (1964).

We hold, therefore, that the public interest in environmental resources—an interest created by statutes affecting the issuance of this permit—is a legally protected interest affording these plaintiffs ... standing to obtain judicial
the other federal circuits. The problem is that the WQIA's only explicit
grant of authority to prohibit violation of water quality standards is
given to government officers.\textsuperscript{105} Nevertheless, the rationale of Citizens
Committee will permit conservationists standing in a suit over alleged
water quality violations. The conflict emerges if the other circuits view
the Act as a codification of the "public official only" doctrine used in
public nuisance law.\textsuperscript{106}

\textit{A Promising Approach: Washington's Site Evaluation Council}

The state of Washington recently enacted a law regulating the
siting of thermal-electric power plants.\textsuperscript{107} The impetus for this legislation
came from both the utility industry and conservation groups; utilities
desired to minimize delay and conflicting design requirements in bringing
power plants into operation,\textsuperscript{108} whereas conservationists wanted greater
consideration of environmental factors in siting decisions. Thus, the
two groups agreed upon a bill which created a "one-stop" agency charged
with weighing both environmental and economic factors when considering
the proposed siting of a thermal-electric power plant. The agency, known
as the "thermal power plant site evaluation council,"\textsuperscript{109} receives applica-
tions proposing a site from an electric utility.\textsuperscript{110} The Council then con-
ducts studies,\textsuperscript{111} holds hearings,\textsuperscript{112} and prepares, within one year, a written
report for the governor containing its findings and recommendations.\textsuperscript{113}
The governor may then issue a certificate plus restrictions, all of which
are binding upon state agencies and the utility.\textsuperscript{114}

Although only eight of the seventeen members on the Council will

\begin{itemize}
\item review of agency action alleged to be in contravention of that public interest.
\item 425 F.2d at 105.
\item In summary, since Citizens Committee permitted an organization formed for the
specific purpose of fighting a single resource decision to obtain judicial review even
though there was no statutory provision authorizing review other than the APA,
only resource decisions that are committed by law to agency discretion can escape
judicial review in the Second Circuit. This conclusion should hold for all circuits since
the Supreme Court has held that a court should restrict access to judicial review only
upon a clear and convincing showing of contrary congressional intent. \textit{See} Abbott
\item 105. 33 U.S.C. § 466g(g) (1964). The Attorney General, after a request by the
Secretary of the Interior, is to bring an abatement suit on behalf of the United States.
\item 106. \textit{See} note 32 \textit{supra}.
\item 107. Laws of Washington 1970, ch. 45. This law shall henceforth be cited only to
its various sections.
\item 108. \textit{See} note 138 \textit{infra}.
\item 109. \textit{Id.} § 3(1).
\item 110. \textit{Id.} § 7(1).
\item 111. \textit{Id.} § 7(2).
\item 112. \textit{Id.} § 9(1).
\item 113. \textit{Id.} § 10(1).
\item 114. \textit{Id.} § 12(1).
\end{itemize}
be representatives of clearly environmental agencies, they should still have an effective voice in Council deliberations since the statute apparently contemplates decisions arrived at by consensus rather than by majority vote. Thus, an agency which could have opposed a project or included restrictions in a license grant under the older system can still do so as a Council member. However, it is anticipated that by functioning as a unit, the Council will temper extreme agency positions and thus prevent conflicting restrictions in plant design and operation.

Since a certificate and any restrictions attached thereto are binding upon state agencies, conservationists insisted that the one-stop procedure insure thorough consideration of all issues pertinent to siting. Consequently, a number of safeguards are built into the statute. First, hearings are to be conducted as “contested cases”, full rights of discovery, cross-examination and all other private litigation devices are available to develop as much information as possible about the proposed site. In order to further insure a full record, the Council is to appoint “independent

115. Id. § 3(3). The Council consists of directors, administrators, or their designees of the following agencies:

(1) Water pollution control commission
(2) Dept. of water resources
(3) Dept. of fisheries
(4) Dept. of game
(5) State air pollution control board
(6) Dept. of parks and recreation
(7) Dept. of health
(8) Interagency committee for outdoor recreation
(9) Dept. of commerce and economic development
(10) Utilities and transportation commission
(11) Office of program planning and fiscal management
(12) Planning and community affairs agency
(13) Dept. of civil defense
(14) Dept. of natural resources
(15) Dept. of agriculture

The Governor appoints a chairman pursuant to § 3(2). The county legislative authority of the proposed site appoints a member as per § 3(4).

116. Conclusion of this author. It was the understanding of the environmentalists that decisions were to be consensual (memorandum from Wm. Rogers, Jr., to members of the Thermal Plant Siting Council on Proposed Guidelines for Thermal Power Plant Site Certification 4 (draft of March 23, 1970), April 20, 1970). Although the original bill was changed during the legislative process, the understanding seems to have survived.

117. Id.

118. Id. § 9(3). A contested case is defined in REV. CODE WASH. ANN. 34.04.010 as:

... a proceeding before an agency in which the legal rights, duties, or privileges of specific parties are required by law or constitutional right to be determined.

Full rights of discovery, productive of evidence and cross-examination are included in the term (memorandum from Wm. Rogers, Jr., to members of the Thermal Plant Siting Council on Proposed Guidelines for Thermal Power Plant Site Certification 2 (draft of March 23, 1970), April 20, 1970).
consultants"\textsuperscript{119} to evaluate the sites. Secondly, the state attorney-general is to appoint a "counsel for the environment"\textsuperscript{120} who will have all the same rights and privileges as provided other parties in "contested cases."\textsuperscript{121} Finally, the governor's decision is subject to judicial review.\textsuperscript{122}

While the Washington law represents the first major attempt to deal with thermal pollution problems, there is one significant defect in the statute which is likely to destroy what impact it was intended to have; the independent consultants appointed by the Council lack sufficient time and finances to conduct a thorough environmental study of a proposed site. They are given only 25,000 dollars\textsuperscript{123} and have, at a maximum, merely nine months in which to investigate and report to the Council.\textsuperscript{124} Thus, all that can reasonably be obtained is superficial information on site characteristics.\textsuperscript{125} Utilities, now studying future sites

\begin{footnotesize}
\begin{enumerate}
\item[119.] Laws of Washington 1970, ch. 45, § 7(2).
\item[120.] Id. § 8.
\item[121.] Id.
\item[122.] Washington's Supreme Court has discovered recently that their obligation for judicial review of agency decisions is more extensive than merely determining whether the agency action was arbitrary, unlawful or capricious. By statute enacted in 1959, Laws of Washington 1959, ch. 234, § 13, the court is also to review and change decisions "unsupported by material and substantial evidence in view of the entire record as submitted." Rev. Code of Wash. Ann. 34.04.130(6) (e) (1965). However, the court was still using the arbitrary, capricious, unlawful standard in Reiger v. Seattle, 57 Wash.2d 651, 359 P.2d 151 (1961) and Cosmopolis Consol. Sch. Dist. v. Bruno, 61 Wash. 2d 461, 378 P.2d 691 (1963). The court found the material and substantial evidence test in City Sanitary Service, Inc. v. Washington Utilities & Transp. Comm'n, 64 Wash.2d 739, 393 P.2d 952 (1964) and used it again in State \textit{ex rel} Pacific Northwest Bell Tel. Co. v. Washington Utilities & Transp. Comm'n, 66 Wash.2d 399, 403 P.2d 54 (1965). The court appears to have consistently followed it ever since. \textit{See}, \textit{e.g.}, State \textit{ex rel} Bremerton Transfer & Storage Co., Inc. v. Washington Utilities & Trans. Comm'n, 67 Wash.2d 876, 410 P.2d 602 (1966); Northern Pac. Trans. Co. v. Washington Utilities & Trans. Comm'n, 69 Wash.2d 735, 418 P.2d 735 (1966); and Black Ball Express Co. v. Washington Utilities & Trans. Comm'n, \textit{—}Wash. 2d—, 463 P.2d 169 (1969). The latter case was decided before legislative amendment of the review standard discussed in the next paragraph.

The Washington legislature in 1967 changed the review standard to read "clearly erroneous in view of the entire record as submitted and the public policy contained in the act of the legislature authorizing the decision or order." Laws of Washington 1967, ch. 237, § 6. This test is surely unique. For an indication of how it may be interpreted, \textit{see} Morse, \textit{Evidentiary Lexicology}, 59 Dick. L. Rev. 86 (1954).

\item[123.] Laws of Washington 1970, ch. 45, § 7(2).
\item[124.] The Council is to report its recommendations to the governor within one year after the utility applies for a site. \textit{Id.} § 10(1). Therefore, the Council must hire independent consultants and the consultants must report their results in time for the Council to make a written report to the governor. It seems unlikely that there will be more than nine months of actual observance of a site's ecology.
\item[125.] The writer's conclusion after a conversation with Dr. Max Proffitt, Professor of Life Sciences, Indiana State University and Research Associate, Indiana University. Dr. Proffitt's expertise in expenditures necessary for adequate information can be gleaned from note 16 \textit{supra}.
\end{enumerate}
\end{footnotesize}
years in advance of anticipated use,\textsuperscript{126} will discontinue efforts to gather sufficient information on environmental effects since they can reasonably rely on the fact that the Council will have little justification to recommend denial of siting upon the inadequate information received from the consultants. In summary, the Council will be approving sites which, with additional information, could be demonstrated to be adverse to aquatic life; with respect to thermal discharge problems the Council will become a rubber stamp for utility interests and proposals.

D. Proposed Administrative Reforms to Prevent Thermal Pollution

In order to effectively control thermal pollution, Congress should create a federal agency which would have broad and comprehensive powers enabling it to achieve a balance between environmental considerations and the demand for electric power. In essence, the agency would be empowered to control siting of proposed thermal-electric power plants so as to minimize the risk of ecological damage. In turn, large scale planning and development of the area where a plant intends to locate becomes feasible. Furthermore, this type of non-industrial control over siting prevents the misallocation of resources.

Thermal discharges of large power plants are capable of causing severe adverse effects on aquatic ecology.\textsuperscript{127} Compounding the problem is the fact that the electric power industry during the next thirty years is expected to double every ten years.\textsuperscript{128} As a result, siting of plants so as to minimize thermal effects becomes essential. However, present site selection procedures go virtually unregulated. The utilities have the power to select sites and their decisions are typically kept secret as long as possible in order that necessary land can be purchased at the lowest possible price.\textsuperscript{129} Under these circumstances there is little opportunity for the effective large scale planning which will be necessary if the sites chosen are to be both as efficient and as harmless to the ecology as possible. Such planning would be feasible if the decisions could be made and coordinated by a single centralized authority rather than left in the hands of the individual power companies.

Centralized authority over siting will also facilitate area wide planning and development. Concentration of industry in an area already over-urbanized would be prohibited.\textsuperscript{130} Instead, the agency would site a

\textsuperscript{126} See note 41 \textit{supra}.
\textsuperscript{127} See notes 17-23 \textit{supra}.
\textsuperscript{128} See note 4 \textit{supra}.
\textsuperscript{129} See note 36 \textit{supra}.
\textsuperscript{130} Cf. discussion of factors relevant to siting decisions, note 27 \textit{supra}.
plant in an area not suitable for, e.g., agriculture, but nevertheless in need of growth. Simultaneously, the industry would be regulated so as to insure the development and maintenance of attractive recreational areas.

Furthermore, the electric power industry does not include in its computations of the cost/benefit ratio all of the costs attributable to power production. For example, because of the difficulty of proving ecological damage, a utility need not include as a cost the effect of thermal discharges upon commercial and recreational fishing. Absent from the the cost of doing business are likely to be additional factors such as scenic beauty, uniqueness of an environment and the historic or tourist value of an area. Contrary to present practice, such costs should be borne by the industry in order to maximize marginal utility per dollar investment. Agency control over siting would prevent the power industry from shifting some of the economic and social costs to others. In summary, agency control over siting will not only insure that thermal discharges do no damage to our environment, but also help fulfill other national needs. Before proposing an agency which will effectively fulfill these goals, an examination of present agency structure and procedure is appropriate. Permeating the entire network of agency responsibility are the problems presented to one who desires to obtain consideration of the impact thermal-electric power plants may have on the environment.

131. See note 27 supra.

132. Sometimes this value can be surprisingly large when measured in terms of the amount of money which the public spends to fish in an area. "Our findings indicated that [the] upper seventeen miles of the Connecticut River in Massachusetts were providing 14,541 angler trips . . . and a present annual recreational value to Massachusetts anglers of 36,350 dollars." 1968 Hearings, supra note 2, at 326 (statement of C.H. Bridges, superintendent, Bureau of Wildlife Research and Management, Massachusetts Division of Fisheries and Game).

The following table presents some data and estimates on a national basis.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Fishermen (Thousands)</th>
<th>Man-Days of Fishing (Thousands)</th>
<th>Expenditures (Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954</td>
<td>20,813</td>
<td>397,447</td>
<td>1,914,292</td>
</tr>
<tr>
<td>1980</td>
<td>46,518</td>
<td>930,379</td>
<td>4,481,144</td>
</tr>
<tr>
<td>2000</td>
<td>62,613</td>
<td>1,299,102</td>
<td>6,257,087</td>
</tr>
</tbody>
</table>


The 1965 value of the Pacific salmon catch was 65 million dollars; in 1966 it had increased another 2 million dollars. Udall v. FPC, 387 U.S. 428, 437 n.6 (1966) citing Dept. of Interior, Fish & Wildlife Service, Fisheries of the United States, at 2 (1965). The commercial catch value of Columbia River salmon is estimated to be worth 12 million dollars while the sport fishing value attributable to the Salmon River in Idaho may be worth as much as 8 million dollars annually. Udall v. FPC, supra, citing Pacific Northwest Power Co., 31 F.P.C. 247, 259 (1964).
At both the federal and state level the authority to regulate the
electric power industry is delegated to agencies. However, these agencies
are either not given the power to consider environmental problems, or
they refuse to exercise their power and merely act as an arbiter between
utilities and their customers, allocating geographic areas and establishing
rates rather than weighing other considerations.

133. For example, the federal government delegates regulatory authority over the
hydroelectric power industry to the Federal Power Commission. 16 U.S.C. § 797(e)
(1964). New York requires utilities to obtain approval of power plants from the
Public Service Commission, N.Y. Public Service Law § 68 (McKinney 1970), and
California demands that a utility receive a pre-construction license from the California

134. E.g., New York law states that no utility may initiate construction of a power
plant unless it has first obtained Public Service Commission approval. N.Y. Pub.
Service Law § 68 (McKinney 1970). But the section is construed to prevent only
intrusion by a utility into another's area; once the Public Service Commission has
issued a certificate to a utility, the utility can build anywhere in area without new
approval. The Commission considers only economic and engineering feasibility in its
determination of the public necessity and convenience. NERBC Rep., supra note
28, at 8. New Hampshire's Public Utilities Commission functions in the same manner.
However, New Hampshire statute provides that no utility can initiate construct
in another's service area. Id. citing R.S.A. 374:23-26.

The public utilities laws of all states were not searched; a representative number
of states were sampled with the public utilities law of those states primarily concerned
with establishing rates and allocating areas. Three states, Illinois, Ohio and Florida,
were intensively searched in an effort to find mention of some factors other than rates
and areas to be used by a public utilities commission in passing upon projects. No
other factors were found.

At the federal level, the FPC was found to have denied only one application on
environmental grounds in a 15 year period for any project in which the power benefits
exceeded the costs. Furthermore, it had never denied a large project regardless of the
possible catastrophic effects.

Note, Of Birds, Bees, and the FPC, 77 Yale L.J. 117, 117 (1967):
E.g., City of Tacoma, 10 F.P.C. 424 (1951), aff'd sub nom. Washington
Dept. of Game v. FPC, 207 F.2d 391 (9th Cir. 1953), cert. denied, 347 U.S. 936
(1954), where the Commission licensed the project, choosing power, flood
control, and navigational benefits, even though they entailed some fish losses,
over retention of the stream in its natural state until economic pressures could
force its full utilization. The agency attached conditions to prevent undue fish
v. FPC, 211 F.2d 347 (9th Cir. 1954) reinstated, 349 U.S. 435
(1955), the Commission licensed and prescribed temporary measures to meet
the need of anadromous fish during construction of the project and approved
permanent facilities for the fish. The agency opted for an estimated $351,000
annual excess of power benefits over power cost in preference to an annual
value of $177,000 for fish using the river above the dam.

Two 1964 decisions indicate that the FPC may be reducing the priority
given to power expansion. The Commission refused to issue a license in
Public Utility District No. 1, 32 F.P.C. 444 (1964), where the area was
already adequately served by the Bonneville Dam (although the project would
have reduced rates slightly) and where fish hatcheries might have been harmed.
1966), rev'd on other grounds sub nom. Udall v. FPC, 387 U.S.
Effective federal control is difficult because jurisdiction over the electric power industry is divided among three agencies; the Federal Power Commission oversees hydroelectric development,\footnote{185} the Army Corps of Engineers has authority over waters withdrawn from navigable waterways,\footnote{190} and the Atomic Energy Commission is charged with promoting the peaceful use of the atom.\footnote{197} Division of authority not only within the federal government, but also among federal, state and local governments\footnote{188} is a primary reason for the lack of effective supervision and control over the power industry.

However, all of the blame cannot be shifted to the legislatures.

\footnote{428 (1967), the Commission chose a site on the Snake River which power experts regarded as the less practical of the two available possibilities, in order to avoid interference with fish runs of the Salmon. \textit{Id.} n.4.}

\footnote{The sole license denied in which power benefits exceeded power costs was Namekagon Hydro Co., 12 F.P.C. 203 (1953), \textit{aff'd} 216 F.2d 509 (7th Cir. 1954). The author of \textit{Of Birds, Bees, and the FPC, supra}, characterizes this decision in footnote 6 in this manner:}

\footnote{The Commission decided that the unique recreational features of the river were of greater public benefit than use of the water for water power development. The proposed project was a minor one, with a capacity of only 1500 kilowatts; thus the decision sacrificed no substantial power benefits. One observer has suggested that the license was "allowed through the mill" to pacify a new Commissioner identified as a "birds and bees" man. Interview with a former Commissioner of the Federal Power Commission, in Washington, D.C., Oct. 6, 1966. The absence of similar decisions since 1953 tends to support the claim that \textit{Namekagon} represented something less than a profound alteration in Commission policy.}

\footnote{The typical stance of the FPC favoring power interests may be the application of an Attorney-General's opinion involving the FPC:}

\footnote{In entertaining applications for licenses, the Federal Power Commission should look only to the effect of the proposed project upon interstate and foreign commerce, and it should not refuse a license because of scenic, recreational, or like considerations. \textit{Op. Att'y Gen.} 314, 323 (1930).}

\footnote{However, the FPC may now be giving greater consideration to environmental effects. In Arkansas Power & Light Co., 40 F.P.C. 522 (1968), the FPC, in licensing a power plant withdrawing water from an FPC reservoir, required more stringent temperature controls than required by Federal Water Pollution Control Administration standards.}

\footnote{135. 16 U.S.C. § 797(a)-(g) (1964).}

\footnote{136. 16 U.S.C. § 797(e) (1964).}

\footnote{137. 42 U.S.C. § 2013 (a), (d) (1964).}

\footnote{138. Mr. Charles Luce, Chairman of the Board of Consolidated Edison of New York described the division of jurisdiction over power plants in this way:}

\footnote{Taking as an example our proposed oil and gas fired units at the Astoria plant, we will need three approvals from Federal agencies, four from New York State agencies, and at least twenty from New York City agencies, the exact number depending upon the final design of the plant. (Speech before the Association of the Bar of the City of New York, Nov. 18, 1969, at 8 \textit{noted by} W. Rodgers, Jr., Memorandum to Washington Members of the Thermal Power Plant Siting Council on Proposed Guidelines for Thermal Power Plant Site Certification, at 1 (April 20, 1970).)}
Agency practices put them in a position where it is impossible to deny a license application on environmental grounds. For example, Iowa requires a utility to purchase a high percentage of the land and easements needed for plant and power lines before applying for formal agency approval. This procedure places an agency in a take-it-or-leave-it posture since agencies typically do not have sufficient staff, time, and money to explore alternative sites and routes which may be more aesthetically or environmentally desirable. As a result, it is virtually impossible for an agency to refuse the economic benefits pressed upon it by the utility, industrial consumers, and labor in favor of an environmental threat not urged by any interest group.

The most serious shortcoming of present agency structure results from the fact that agencies are severely understaffed and lack personnel trained to recognize ecological threats. Consequently, an agency is forced to rely upon information developed by the power companies' outside consultants who, while probably conscientious, may be biased unless they are scientists not dependent upon the power industry for their livelihood. Thus, the agency finds itself in the position of the poverty-stricken opposer in the courtroom; it can only raise questions. Since the utilities can be expected to have conducted some studies leading to tentative conclusions that little ecological damage will result, the utility will resist any agency request for more information on grounds that (a) it will unnecessarily delay the facility's going "on line" to relieve a presently existing power shortage and (b) the company will continue studies as construction proceeds and if any adverse effects are proven, modifications will correct or minimize them.

Unnecessary delay is an effective argument since many companies are currently operating below the FPC's recommended reserve capacity. With demand increasing each year, even a year's delay can seem an exorbitant price. By coupling this argument with an offer to make modifications that continued research demonstrates is necessary, the utility can expect to overcome any objections which an agency, state or federal, may have. While realizing that it is economically inefficient to

---

139. 54 Iowa Eminent Domain, supra note 46, at 769.
140. Id. at 774-75.
141. Id.
142. Id. at 774. Finding impartial scientists qualified to undertake site studies will be difficult. Even college professors specializing in ecology would be under some pressure to conclude that the site was "safe," since utilities would probably not be anxious to hire a researcher who had recommended against a site.
143. The Wall Street Journal reports that "39 of 181 major systems have reserves of less than 10 per cent compared to the FPC's" recommended 15-20 per cent minimum reserves. Wall Street Journal, March 23, 1970, at 1, col. 1.
construct devices to control a problem which may not exist, it is submitted that where the potential harm is as great as it is in thermal discharges, more should be required of a utility than an offer to continue research. Events have demonstrated too many times that once vested interests are created, construction will not be abandoned without, and occasionally even in spite of, the clearest proof of severe environmental disruption.\textsuperscript{144}

Because the threat of thermal pollution is one of the nation’s most serious problems, and one which present agency structure and licensing procedure is incapable of combating effectively,\textsuperscript{145} a new federal agency should be established to regulate the public utilities industry. The establishment of one central authority over thermal discharge is justified for the following reasons. First, since utility companies site plants by studying the power use, production and direction of growth on a regional basis, effective regulation demands an agency having power on a regional scale. Secondly, one federal agency with sole siting power will eliminate the problem of industries locating in states where water quality standards are either non-existent or relatively remiss. The avoidance of forum shopping is another justification for the creation of one federal agency. Lastly, one federal agency can achieve economies of scale and afford to pay the higher salaries necessary to attract the talented men who will be so important in assuring that explosive electric power growth will not endanger our environment.\textsuperscript{148}

Having shown the need for a new federal agency with centralized and comprehensive authority, its precise structure and powers will now be set forth. Congress should create a Federal Public Utilities Agency\textsuperscript{147} possessing the power to grant or deny construction of any proposed electric power generating facility in the United States. The FPUA would have approval power over atomic-electric, conventional, and hydroelectric power plants, as well as any new technological devices for generating electricity. Agency authority over all types of electric power producing facilities is essential so as to insure that future power development will be based upon mature choice after consideration of all important factors.\textsuperscript{148} Moreover, no one fuel source should have a special preference. Assuming that the heat source of the future is atomic power,\textsuperscript{149} it is unwise to

\begin{footnotesize}
\begin{enumerate}
\item[144.] \textit{See} note \textsuperscript{27} \textit{supra}.
\item[145.] \textit{See, e.g., Iowa Eminent Domain, supra} note 46.
\item[146.] \textit{Cf. 54 Iowa Eminent Domain, supra} note 46, at 774.
\item[147.] Hereinafter referred to as FPUA.
\item[148.] \textit{See} note \textsuperscript{27} \textit{supra}.
\item[149.] This is based upon such factors as comparative cheapness of atomic fuels and their abundance, decreasing supply of organic fossil fuels and increasing pressures that can be expected to consume these fuels only to manufacture products for which there is not a convenient substitute, decrease in air pollution, expected increase in
\end{enumerate}
\end{footnotesize}
insure this result simply because the Atomic Energy Commission is under congressional charge to promote peaceful use of the atom. Decisions on the preferability of any type of power should depend upon such considerations as air and thermal pollution, radiation, aesthetic beauty, historical interest, and fuel expense.

The FPUA would also have the authority to initiate long range planning and development; consequently, it should have the sole responsibility of deciding the siting of an electric power plant. To fulfill this responsibility and to assure that only the better sites will be chosen for electric power sites, the FPUA should eventually purchase all sites used for power generation either outright or through options. Ecology studies would be conducted by agencies that have expertise in an environmental area. They would be responsible for gathering the necessary data as to the possibility of environmental effects, with such agency's recommendation binding upon the FPUA. For example, when a utility applies to construct a thermal-electric plant on a river, the Fish & Wildlife Service would make binding determinations on the permissible temperature rise in the condenser and/or the waterbody, the size and shape of any permissible mixing zone, and the type of screens over the intake pipes. The Army Corps of Engineers would make binding determinations on any aspects within its jurisdiction. The Atomic Energy Commission would control construction of an atomic facility and a federal agency with jurisdiction over air quality would ascertain whether the plant could maintain discharges within air quality limits.

Another advantage to authority over long range planning situated in a single agency is that it would promote agency consideration of the total land use picture. Siting would thus occur in areas where it is desired to attract industry and away from areas which are to be residential, likely to lead to excessive urban concentration, or where the land is too valuable recreationally, historically, or agriculturally. By removing utilities from the land acquisition process in this manner, reliance upon technological devices to minimize harm can be more effectively replaced by intelligent siting.

Finally, if the FPUA is to be truly effective, it must have the authority to make three recommendations: (1) that no plant be built on a site for environmental reasons, (2) that a plant be built which conforms to applicable water, radiation and air quality standards, or (3)

---

efficiency of atomic-electric power generation, stringent safety standards and safety record, greater aesthetic attractiveness of such plants over conventional facilities and almost exhausted supply of hydroelectric sites which can be commercially developed. 
Cf. note 27 supra.
that a plant be built conforming to criteria more stringent than applicable state water quality standards.

Hearings would begin only after environmental agencies determine that sufficient information about a site has been collected. In order to minimize delay and expense, the FPUA would have authority to suggest that all agencies conduct their hearings together. Furthermore, if it appeared that obtaining a license from any one agency would be the critical step in the licensing procedure, the FPUA should order a utility to apply to that agency first. The hearings would be held in the locality affected by the siting, and copies of plans and specifications should be distributed at least sixty days in advance so as to provide opposers with sufficient time to secure technical and legal advice. The statute creating the agency should specifically grant to opposers the right to contend that harm will occur even if state or federal standards, or the more stringent standards that an agency may recommend, are met. Opposers should also have the right to contend that the plant should not be built for aesthetic or some other similar reason.

After the environmental agencies have made their recommendations, the FPUA would have authority to examine all relevant factors in considering the license application. For example, if it appears that a plant cannot be constructed in a manner so as to meet all of the environmental agencies' recommendations, the license should be denied. In addition, the FPUA should have authority to modify the plan if both the company and environmental agencies agree. For example, if the utility initially applies to build an atomic-electric plant at a site where it appears that a conventional thermal-electric plant would present less of a threat to aquatic life, the FPUA could so alter the plans. The amended plans would then have to meet with the approval of the environmental agencies. This procedure would obviate having to initiate the licensing process anew and should not cause undue delay since the environmental studies have already been made.

Judicial review should occur at that time which will most facilitate the licensing process. Thus, even though review will generally not occur until after FPUA action on the application, if the FPUA determines that the licensing process will be ultimately shortened by immediate review of an environmental agency's decision, then the courts should grant review of that agency's determination. The statute establishing FPUA should explicitly permit opposers to repeat on judicial review any contentions that were maintained before an agency.

150. Cf. NERBC REPORT, supra note 28, at 76.
151. Id. at 77.
Criteria For Judicial Review

Obtaining judicial review of an agency determination adverse to opposers is often difficult to do. Even assuming that opposers can bear the expense of additional litigation, there is little likelihood that the merits of their contentions will receive full consideration. Although the courts are given the power to review an agency decision, the doctrine of standing is the primary obstacle confronting opposers; in order for opposers to obtain judicial consideration of their contentions, they must show that they are the "aggrieved" party of an agency order:

Any party to a proceeding under this Act aggrieved by an order issued by the Commission . . . may obtain review of such order in the Circuit Court of Appeals . . . for any circuit wherein the licensee or public utility to which the order relates is located . . ., or in the United States Circuit Court of Appeals for the District of Columbia . . .

One of the first major judicial pronouncements on the issue of who is an aggrieved person occurred in the case of FCC v. Sanders Brothers Radio Station. The Court denied petitioner standing to complain of any economic injury resulting from competition, but did hold that petitioner was a "person aggrieved," in the sense that he could assert that the license granted to respondent was not in the public interest. Shortly thereafter, in the case of National Broadcasting Co. v. FCC the District of Columbia Circuit Court stated in dicta that non-economic injury was within the scope of the term "aggrieved" when it decided that prospective signal interference with a commercial radio station conferred standing upon that station to appeal a grant of a new license to another

152. See note 32 supra.
153. This is particularly true in state courts which employ review standards that tend to favor the agency's decision. For example,
[w]hen the criteria for court review is [sic] that (1) the evidence before the agency is not sufficient to support a grant of franchise, or (2) the agency has acted arbitrarily or fraudulently or in bad faith, there is almost no chance for the opposers to challenge the agency decision successfully. Iowa Eminent Domain, supra note 46, at 772. E.g., Harvey v. Iowa State Highway Comm'n, 256 Iowa 1229, 1231, 130 N.W.2d 725, 727 (1964). Maryland has just recently abandoned the "arbitrary" test, Md. ANN. CODE, art. 78, § 54 (1969), 1968 Hearings, supra note 2, at 663.

Equally unsatisfactory, in view of the ever-increasing threat to the environment, are criteria requiring only that the evidence be "sufficient" to support the agency's determination. E.g., Warminster Twp. Municipal Authority v. Pennsylvania Pub. Util. Comm'n, 185 Pa.Super. 431, 138 A.2d 240 (1958).
155. 309 U.S. 470 (1940).
156. 132 F.2d 545 (D.C. Cir. 1942).
The Supreme Court, finding that the FCC's act permitting signal interference constituted a modification of complainant's license, affirmed on the narrower ground that the FCC must permit the station whose license may be modified to participate in the modification hearing. As a result, the FCC began to argue that signal interference was the only non-economic injury situation that confers standing. Other federal agencies picked up the argument that members of the regulated industry could assert non-economic interests, but non-members needed an economic interest. However, in light of several recent court decisions affecting numerous agencies, this argument retains little vitality. Two of these decisions will be discussed because of their significance to environmental litigation.

In *Scenic Hudson* the FPC argued that the petitioners, "three towns and an unincorporated association of groups of persons 'interested in conservation of natural resources,'" lacked standing to protest the Commission's issuance of a license to Consolidated Edison for the purpose of building a pump storage project at Storm King Mountain. Recognizing that the concept of aggrievement as a basis for standing has been accorded broad scope in recent years, the FPC nevertheless contended that "at least a likelihood of economic injury to the would-be litigant" was still required.

Rejecting this contention, the court stated that whereas Congress cannot statutorily confer upon a set of facts the constitutional essential of a "case or controversy," it can create new interests or rights in a given set of facts and thereby confer standing upon one who would otherwise lack a "case or controversy." Furthermore, this constitutional

---

157. The court said the decision would have been the same even if the prospective interference had been to a non-profit station. *Id.*
160. 354 F.2d 608 (2d Cir. 1965).
161. Motions to Dismiss and Brief for Appellee at 9, *Scenic Hudson Preservation Conf. v. FPC*, 354 F.2d 608 (2d Cir. 1965).
162. *Id.* at 14.
164. *Cf.* Judge Frank in *Assoc. Industries*:
While Congress can constitutionally authorize no one, in the absence of an actual justiciable controversy, to bring a suit for judicial determination either of the constitutionality of a statute or the scope of powers conferred by a statute upon government officers, it can constitutionally authorize one of its own officials, such as the Attorney General, to bring a proceeding to prevent another official from acting in violation of his statutory powers; for then an actual controversy exists, and the Attorney General can properly be vested with authority, in such a controversy, to vindicate the interests of the public or the government. Instead of designating the Attorney General, or some other public
THERMAL ELECTRIC POWER

essential neither demands a personal economic interest in an “aggrieved” or “adversely affected” party, nor does the Federal Power Act seek to protect only economic interests. Consequently, those people having a “special interest” in an environmental area that may be adversely affected by a thermal-electric power plant fall within the class of aggrieved parties:

. . . in order to insure that the Federal Power Commission will adequately protect the public interest in the aesthetic, conservational and recreational aspects of power development, those who by their activities and conduct have exhibited a special interest in such areas must be held to be included in the class of aggrieved parties under § 313(b).166

However, whether a “special interest” could be one totally unrelated to economic factors was left in doubt since the court also noted that Scenic Hudson did have an economic interest: one of the two conservation groups which organized Scenic Hudson would have portions of its seventeen miles of trails in the area inundated by the reservoir. This possible narrow reading of the case set the stage for Citizens Committee167 where the plaintiff did not claim an economic interest.

In Citizens Committee the state of New York needed a permit from the Army Corps of Engineers authorizing it to dredge and fill portions of the Hudson River in order to build a segment of a six lane highway. The Village of Tarrytown, a chapter of the Sierra Club, and the Citizens Committee for the Hudson Valley, a previously non-existent group which organized solely to fight this project, opposed issuance of the permit. Nevertheless the Corps issued it pursuant to its authority under section nine of the Rivers and Harbors Act of 1899.168

On the issue of whether the plaintiffs had standing the court quoted a portion of the opinion in Office of Communications of United

officer, to bring such proceedings, Congress can constitutionally enact a statute conferring on any non-official person, or a designated group of non-official persons, authority to bring a suit to prevent action by an officer in violation of his statutory powers; for then, in like manner, there is an actual controversy, and there is nothing constitutionally prohibiting Congress from empowering any person, official or not, to institute a proceeding involving such a controversy, even if the sole purpose is to vindicate the public interest. Such persons, so authorized, are, so to speak, private Attorney Generals.

Assoc. Industries v. Ickes, 134 F.2d 694, 704 (2d Cir. 1943), dismissed as moot, 320 U.S. 707 (1943).

165. 354 F.2d at 616.
166. Id.
167. 425 F.2d 97 (2d Cir. 1970).
Church of Christ v. FCC, to the effect that the doctrine was a "... practical and functional [concept] designed to insure that only those with a genuine and legitimate interest can participate in a proceeding . . . ."
Upon finding that the plaintiffs, a group of conservationists, possessed the requisite "legitimate interest," the court held:

... that the public interest in environmental resources—an interest created by statutes affecting the issuance of this permit— is a legally protected interest affording these plaintiffs ... standing to obtain judicial review of agency action alleged to be in contravention of that public interest.171

However, obtaining judicial review will be valueless if the court employs criteria which inordinately favor the agency's position. Therefore, it is submitted that in reviewing agency decisions approving construction or operation of thermal-electric power plants, the court should require affirmative answers to three questions. First, does the record before the agency contain clear and convincing evidence of the need for more power? Secondly, does a preponderance of the evidence indicate an acceptable minimal risk of environmental damage? Finally, is there also a preponderance of evidence indicating that the approved project is the best alternative?

Before considering whether some courts may already be employing similar standards, it is appropriate to ask why the review standard should be so high. With respect to the first criterion, given the fact that the demand for electric power is expected to double every ten years for at least the next thirty plus the fact that great ecological dangers are presented by thermal discharges, the requirement of a clear and convincing showing that more power is needed in the utility's service area is not too exacting. Indeed, if the company cannot show this, then it is fair to state that the plant should not be built. The reason that the second criterion is set so high is because of the great stresses caused by thermal discharges. Moreover, when additional information is acquired on the intricacies of aquatic ecology, the standard can be expected to rise. Because of the difficulties in predicting new power producing technology, an argument of some force can be made that the third standard is too high. However, this argument is weakened when it is realized that the wrong choice can mean the elimination of many species upon which

169. 359 F.2d 994 (D.C. Cir. 1966).
170. Id. at 1002.
171. 425 F.2d at 105. For a fuller discussion of this case, see note 104 supra.
172. See note 25 supra.
man may depend for survival. Nevertheless, should it develop that the preponderance criterion is too high, the courts can be expected to establish an appropriate evidentiary level to insure that enough electricity is produced to satisfy our needs.

The cases, *Scenic Hudson* and *High Mountain Sheep* may indicate that courts are presently developing similar standards. In *Udall v. FPC*, two private power companies sought authority from the FPC to construct a dam at two mutually exclusive sites, High Moutain Sheep and Nez Perce. The Secretary of Interior initially opposed both projects, contending that alternative power sources were available for the region in the future. However, the Secretary later sought federal authority to build at HMS; in spite of this, the FPC granted Pacific Northwest Power Company, a private firm, a license for HMS. The Secretary appealed on the grounds that the Commission lacked power to approve private dam construction whenever it appears that "the development of any water resources for public purposes should be undertaken by the United States." The Supreme Court reversed and remanded, finding that no factual inquiry had been made on the record into the Secretary's claim. Although the Court decided the narrow issue presented by the case, it chose to inquire into the power of the Federal Power Commission to license any hydroelectric project:

... the test is whether the project will be in the public interest. And that determination can be made only after consideration of issues relevant to the 'public interest', including future power demand and supply, alternate sources of power, the public interest in preserving reaches of wild rivers and fish for commercial and recreational purposes, and the protection of wildlife.

The significance of the case is that it apparently applies the fore-

---

173. 387 U.S. 428 (1966). [Hereinafter referred to as *High Mountain Sheep*].
174. Hereinafter referred to as HMS.
177. The Secretary did not participate in the hearings before the presiding examiner. After the examiner's decision recommending that the FPC issue a license to Pacific Northwest Power, the Secretary was permitted to intervene, but he was limited to filing exceptions and participating in oral arguments. The Secretary asked for a rehearing and reopening of the record after the full commission ruled there was no evidence in the record to support his position. After a rehearing in which the record was not opened, the commission reaffirmed the examiner. Pacific Northwest Power Co., 31 F.P.C. 1051 (1964).
178. 387 U.S. at 450.
mentioned three-pronged standard rather than the traditional criteria of review for FPC actions.\textsuperscript{179} With respect to the first prong, although the two private companies introduced large quantities of evidence on their own,\textsuperscript{180} the most convincing fact indicating that there is a need for more power in the region is the reversal of position by the Secretary. During the FPC hearings he argued that planned and installed capacity would last at least until 1972.\textsuperscript{181} However, when the case was before the Supreme Court, he was urging that dam construction begin immediately.\textsuperscript{182} Thus, one can reasonably conclude that there was at least a preponderance of evidence indicating a need for more power. That the second prong, minimizing environmental disruption, was considered by the FPC is revealed by the fact that the agency approved HMS over Nez Perce in order to protect salmon migration even though the latter site would have provided cheaper power.\textsuperscript{183} The third prong, substantial evidence that the approved project is the best alternative, appears satisfied because the Secretary proposed five alternatives for producing power. All were rejected as either not providing a reliable source of power, offering less benefit per dollar cost, or risking unnecessary environmental damage.\textsuperscript{184}

Nevertheless, the Supreme Court remanded with "advice." Why? The answer lies in the Court's definition of the public interest test. The test is defined in terms of three issues: (a) need for power, (b) alternative sources, and (c) environmental effects.\textsuperscript{185} The dissenting opinion suggests that the Court was aware that it was abandoning the general test:

\ldots I had not before understood the evidence marshaled in support of an agency's finding must, if it is to be credited, have been tidily categorized at the hearing for the purposes for which it might subsequently be employed.\textsuperscript{186}

\textsuperscript{179} See, e.g., City of Pittsburgh v. FPC, 237 F.2d 741 (D.C. Cir. 1956); Michigan Consolidated Gas Co. v. FPC, 283 F.2d 204 (D.C. Cir. 1960), cert. denied, 364 U.S. 913 (1960). The fact that both these decisions are District of Columbia Circuit decisions requires the FPC to consider alternatives, since an appellant may choose to seek review in either the D.C. Circuit or the home circuit of the utility. 16 U.S.C. § 825t(b) (1964).

\textsuperscript{180} The hearing record is more than 14,000 pages long. 387 U.S. at 454 (dissenting opinion).

\textsuperscript{181} 387 U.S. at 444-46 (excerpts from the Secretary's intervention petition).

\textsuperscript{182} Id. at 455 n.7 (dissenting opinion).


\textsuperscript{184} Id. at 258-64 and nn.14 & 15; id. at 1051, 1052-54 and nn.2-8.

\textsuperscript{185} See text accompanying note 178 supra.

\textsuperscript{186} 387 U.S. at 454 (dissenting opinion).
If this analysis is correct, then the decision provides a clue to the extent of consideration that the FPC must give to environmental impact of the projects it licenses. It is possible to persuasively characterize the amount of evidence which the FPC considered on environmental effects as substantial in terms of volume. Furthermore, the Commission, after choosing the more expensive site in order to protect as many fish as possible, remanded to the presiding examiner for greater consideration of fish protection devices. Thus, the point is not the amount of evidence considered, but the efficacy of the proposed solution. The Court, unhappy with Commission dependence upon an unproven technological device to save anadromous fish, demands effective environmental protection.

*Scenic Hudson,*187 decided three months before and cited by *High Mountain Sheep,* exemplifies another court that may be working toward a three-pronged review test. Even though the court found so little evidence of consideration of alternatives that it could have remanded on that point alone, it discussed aesthetic and conservation values not satisfactorily considered by the Commission and emphasized shortcomings in the record on whether any technological device could save fish eggs and larvae of the striped bass whose spawning grounds were near the project. The court's order to the Commission said that

... the Commission should take the whole fisheries question into consideration before deciding whether the Storm King project is to be licensed.

The Commission should examine all questions on which we have found the record insufficient and all related matters. The Commission's renewed proceedings must include as a basic concern the preservation of natural beauty and of national historic shrines.188

The FPC recently re-issued the license to Consolidated Edison for construction of the Storm King project;189 possibly the Second Circuit will now get a chance to decide more than merely that an agency's planning process did not include the appropriate values, but that the agency misconceived the importance of the values which it decided to exchange for more power.190 This is the ultimate question on reviewing

---

187. 354 F.2d 608 (2d Cir. 1965). The standing issue raised by this case is discussed in notes 160-67 supra and accompanying text.
188. 354 F.2d at 624.
190. It is possible that the Second Circuit could remand again if the following observation is correct:

The prepared testimony submitted by staff counsel prior to the *Scenic Hudson*
agency decisions affecting the environment; *High Mountain Sheep* intimates that courts will soon explicitly decide it.

CONCLUSION

Some of the physical ramifications of injecting extra heat into aquatic ecosystems have been mentioned along with possible technological devices to minimize thermal effects so as to prevent thermal pollution. It has been recommended that legal concepts of nuisance be abandoned, numerical standards for temperature elevation be established, and standing in private persons and organizations to obtain judicial review be expanded. Furthermore, since courts are ill-equipped to handle thermal discharge problems where so much attention must be devoted to drawing lines based upon voluminous information, Congress should create a federal agency with extensive siting powers. Review of agency decisions should employ a three-pronged test in order to prevent agency arbitrariness and to insure consideration of all values involved in siting thermal power plants. These recommendations are designed to give appropriate consideration to the ecological impact of thermal discharges at the siting stage of the planning process when alterations and modifications can be most easily and inexpensively undertaken.

BILLY DARRELL McDANIEL

rehearing failed to reflect the spirit of the remand. The staff case contained evidence on alternatives to the Storm King project, but very little testimony on the wider range of non-power questions involved in the application. The agency's non-power testimony came from the Commission's own fish expert and an air pollution expert from the Public Health Service. Left untouched were many of the geological, aesthetic, and other non-power issues raised by Scenic Hudson's witnesses.

... Still, counsel arguably acted within the letter of the remand, since the Second Circuit had not specified the latter issues for further inquiry.

The staff counsel demonstrated his leaning toward traditional power interests early in the rehearing when, in response to several objections by the attorney for one of the conservationist organizations, he remarked that the utilities "have to have real temerity these days in view of the opposition of the Sierra Club." N.Y. Times, Dec. 9, 1966, at 36, col. 4.

*Note, Of Birds, Bees and the FPC, 77 Yale L.J. 117, 129 n.44 (1967).*

However, the author's personal opinion is that in view of the fact that citizen protests have blocked additions to Consolidated Edison's power supply since the early 1960's, *Wall Street Journal*, April 3, 1970, at 22, col. 2, the Second Circuit, should the case be appealed again, will probably have to approve or disapprove the project so that Con Edison can make firm plans to meet power demand.
INDIANA LAW JOURNAL

Volume 46    FALL 1970    Number 1

INDIANA UNIVERSITY SCHOOL OF LAW

BOARD OF EDITORS

Editor-in-Chief

MICHAEL D. O'CONNOR

Executive Editor

JAMES P. MULROY

Articles and Book Review Editor

RONALD L. CHAPMAN

Managing Editor

JUDITH A. MITNICK

Note Editors

ROBERT H. GULLICK

LARRY R. LINHART

R. NEIL IRWIN

JAMES J. WILSON

Editorial Assistants

MARY J. CAVINS

DALE S. PRYWELLER

CORY BRUNDAGE

BILLY DARRELL MCDANIEL

JAMES D. KEMPER

RORY O'BRYAN

CONTRIBUTORS TO THIS ISSUE

THEODORE F. DENNO: B.S., City College of New York; Ph.D., University of Maryland; Assistant Professor of Political Science, State University of New York, College at Cortland.

WENCESLAS J. WAGNER: LL.M. 1939, University of Warsaw; J.D., LL.M. 1953, S.J.D. 1957, Northwestern University; LL.D., University of Paris; Professor of Law, Indiana University.

Copyright © 1970 by the Trustees of Indiana University.