FACULTY RESEARCH NOTE

ALLOCATING THE BURDEN OF ENVIRONMENTAL UNCERTAINTY: THE NRC INTERPRETS NEPA'S SUBSTANTIVE MANDATE

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I. INTRODUCTION

This Note reports and analyzes a recent decision by the Nuclear Commission (NRC) interpreting the National Environmental Policy Act of 1969 (NEPA).1 In In re Consolidated Edison Company of New York, Inc. (Indian Point Station Unit No. 2) (Indian Point Two)2 an NRC Appeal Board3 held that NEPA required the agency to condition the license for a proposed power plant upon the licensee’s either mitigating certain environmental damage caused by the plant, or ceasing operations. Thus the case is noteworthy because it reflects a clear recognition that NEPA imposes a dual duty on federal licensing bodies: a procedural duty to evaluate the environmental impact of proposed projects, and a substantive duty to deny licenses unless certain environmentally damaging features of the project are eliminated.

The decision, however, has even broader significance. The record in Indian Point Two showed that while there would be environmental harm

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* Much of the research which appears in this note was done originally for a section entitled Environmental Defense: Interest Group Advocacy in Complex Disputes, which will appear in the forthcoming book: B. WEISBROD, J. HANDLER & N. KOMESAR, PUBLIC INTEREST LAW: AN ECONOMIC AND INSTITUTIONAL ANALYSIS, to be published in 1978 by the University of California Press. That section will contain a more detailed description of the facts and history of the Indian Point controversy discussed in this note as well as complete documentation of the factual data presented herein.

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3. At the time of the Indian Point Two case, the agency involved in the decision was the Atomic Energy Commission (AEC). The AEC has since been divided into two separate bodies—the Nuclear Regulatory Commission and the Energy Research and Development Administration. See 42 U.S.C. §§ 5801-5891 (Supp. V 1975). For convenience, the decision-making body will be referred to as the NRC throughout this note.
from the licensee's proposed design, the extent of that harm was uncertain. Further, the agency was not able fully to quantify the environmental benefits that would be secured by the costly redesign requirements it imposed on the utility. Therefore, the case illustrates how one agency has dealt with two recurrent problems in environmental analysis: uncertainty, or imperfect information about the potential environmental impacts of projects, and unquantifiability, or lack of adequate data fully to assign dollar values to the social costs or benefits of proposed actions. Specifically, it demonstrates how the NRC interpreted NEPA's substantive mandate in a case of this nature as imposing the burden of proving that environmental protection measures were unnecessary.

This Note has three purposes. First, it is designed to draw attention to an important environmental law decision that has received no prior attention from commentators. This decision is significant because of its interpretation of NEPA's substantive mandate, its recognition of the problems of uncertainty and unquantifiability, and its imaginative use of the burden of proof to handle such situations. But in order to understand the value of Indian Point Two as a precedent to be used by lawyers, administrators, and judges in analyzing specific NEPA cases, or its utility for future development of NEPA guidelines by the Council on Environmental Quality and the agencies, it is necessary to see the opinion within the framework of a legal-economic analysis of NEPA which is implicit in the decision but which was not adequately developed by the NRC. Thus, the second goal of the Note is to create such an analytic framework. By applying elementary economic concepts to the legal principles established by NEPA, the Note constructs an analytic system that makes it possible more fully to understand the holding in Indian Point Two and the relevance of that holding to future environmental controversies. Finally, the Note suggests how this analysis could be used to develop more comprehensive guidelines for agency decisionmaking in situations of uncertainty and unquantifiability. While asserting that it would be highly desirable if specific agencies or the Council on Environmental Quality would develop such guidelines, the Note argues that before that occurs further work should be done to develop the legal-economic framework suggested here, and to apply it to detailed analyses of actual agency decisions in cases like Indian Point Two. If such research is conducted and the findings are translated into more specific guidelines, the full potential contribution of Indian Point Two to environmental law can be realized.

II. NEPA: SUBSTANCE AND PROCEDURE IN ENVIRONMENTAL POLICYMAKING

In the late 1960's, the United States Congress undertook a major review of the effect of federal government programs on the environment. Several congressional committees produced studies on environmental
policy and held hearings to investigate the process of federal decision-making. NEPA emerged out of this review. The statute is a broad-reaching injunction to federal agencies to transform their policies relating to environmental issues and the processes they employ to evaluate the environmental significance of their actions. Specifically, NEPA establishes environmental protection as a national policy and requires federal agencies to prepare detailed statements of the environmental impact of proposed actions prior to approving projects, programs, and policies.

There has been sharp debate on the precise legal impact of NEPA on the agencies. Some have seen it as purely a procedural statute, merely requiring agencies to conduct an analysis of environmental impact. Others have seen NEPA as containing a substantive mandate, dictating in certain cases the course of action agencies must follow if they discover a project has substantial environmental impact.

This debate has principally focused on the relationship between agency discretion and judicial review of agency environmental decisions. It is widely accepted that NEPA expands agencies’ substantive powers, permitting them, for example, to include environmental protection among the goals Congress has authorized them to pursue in programs and projects and in the exercise of licensing authority. (This is called the “mandate expanding” feature of the law.) What is less clear is whether NEPA requires agencies to exercise such power, or whether the statute merely authorizes them to do so if in the exercise of their discretion they deem such action appropriate. Since this question normally arises in the context of judicial review of agency decisions, the debate about the relation between “substance” and “procedure” has largely been cast in terms of whether a federal court can order an agency which has conducted an adequate environmental review of an action not to proceed with that action because of its environmental effects.

Proponents of the “substantive” theory of NEPA therefore have been principally concerned with encouraging the judiciary to develop a body of rules or principles governing agency actions which could be enforced in the courts. The question whether the judiciary has such power has never been definitively resolved. Some judges have asserted the existence of such a power. But it has rarely been employed. Rather,

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7. See, e.g., Anderson, supra note 5, at 303-11.

8. For a recent article on judicial willingness to assume a “substantive” role, see
most courts have limited themselves to close scrutiny of agency decisions to determine if the record in the case contains adequate data concerning the environmental impact of the action. Frequently, the courts have found the record lacking in this respect, and have enjoined further proceedings until an adequate environmental impact statement has been prepared. But it is difficult to find cases in which courts have held that a decision reached on an adequate record violates NEPA.

This judicial reluctance to exercise substantive review powers is not surprising. In the first place, some judges doubt whether Congress intended the courts to play such a role. This position is not hard to understand. The so-called "substantive" provisions of NEPA are exceedingly general. At the same time most significant environmental controversies present complex issues of fact and policy whose analysis demands substantial time and expertise. It is little wonder that judges are wary of entering into such thickets without either more specific substantive guidance or explicit congressional authorization for this type of judicial review. Yet NEPA and its legislative history are silent on the precise role courts are to play in reviewing agency decisions.

At the same time, courts have recognized that NEPA implies an active role for the judiciary. One of the major purposes of the statute was to correct a tendency of federal agencies to undervalue environmental considerations in program and project decisions. But given the causes of this anti-environmental bias, it is not likely that the agencies themselves would take the corrective measures Congress desired. The tendency for


10. Some federal courts have been willing to review the agencies' decisions on what items need to be included in the agencies' calculus, and a few have been willing to take a hard look at the valuations placed on costs and benefits. But, with only one exception, the courts have refused to second-guess the agencies' resulting balance. For the exception, see Montgomery v. Ellis, 364 F. Supp. 517, 529-32 (N.D. Ala. 1973). In Montgomery an environmental impact statement was rejected in part because the court held that the discount rate used by the agency was arbitrary.


12. See text accompanying notes 21-26 infra.


14. See Liroff, supra note 4, at 31-34.
agencies to undervalue environmental protection frequently stems from a conflict between the agency’s primary mission and environmental needs. Many federal agencies are charged with carrying out programs that can only be achieved at some cost to the natural environment. For example, an agency whose primary mission is the construction of dams is not likely to be sensitive to environmental values which can only be protected if dams are not built. Since in passing NEPA Congress was concerned with correcting abuses that flowed from this kind of built-in anti-environmental “bias,” it would seem unlikely that the legislature expected the statute to work without some external check on agency decisions. And since no administrative body was given the power to review specific agency decisions under NEPA, it is not surprising that federal judges decided that it was appropriate for the courts to review agency performance.\textsuperscript{15}

Further, the structure of NEPA encourages judges to take a closer look at agency decisionmaking under NEPA than they would under many other statutes. In many areas of administrative law, courts tend to defer to agency decisions because it is presumed that agencies have substantial expertise in the subject matter. But considerations of agency “expertise” tend to cut the other way under NEPA. An agency’s expertise tends to be in the area of its primary mission: building dams, licensing power plants, and the like. Since this mission may conflict with environmental needs, agencies may be less, rather than more, able to evaluate environmental issues than courts. Thus, judicial review may be more important under environmental policy acts than under other types of administrative law.\textsuperscript{16}

These factors may explain why courts have been willing to intervene in many projects that have environmental implications, halting further action until adequate environmental analysis is completed.\textsuperscript{17} However, this willingness to intervene has been principally limited to the use of powers of “procedural” review; that is, to determination of whether the requirement for an adequate environmental impact statement has been met. Courts have been extremely reluctant to deal with the difficult and

\textsuperscript{15} See, e.g., Calvert Cliffs’ Coordinating Comm., Inc. v. United States Atomic Energy Comm’n, 449 F.2d 1109 (D.C. Cir. 1971). In this, the leading case involving NEPA’s interpretation, the court stated that NEPA’s procedural requirements established a strict standard of compliance. Further, the court continued, NEPA’s “procedural” provisions required that agencies secure information about environmental effects and consider this information in “finely tuned and ‘systematic’ balancing analyses.” Id. at 1113. In addition, the court said: “Our duty, in short, is to see that important legislative purposes, heralded in the halls of Congress, are not lost or misdirected in the vast hallways of the federal bureaucracy.” Id. at 1111.

\textsuperscript{16} For a thoughtful recognition of this point in the context of a state version of NEPA, see Wisconsin Environmental Decade, Inc. v. Public Service Comm’n, 79 Wis. 2d 161, 255 N.W.2d 917 (1977).

\textsuperscript{17} In a number of cases the courts have considered the scope of judicial review of agency decisions under NEPA. The courts have generally stated that they will make a substantial inquiry to determine whether there has been a clear error of judgment. To do this, courts will ask if the agency reached its decision after a full, good faith consideration of environmental factors. See, e.g., Environmental Defense Fund, Inc. v. Froehlke, 473 F.2d
troublesome question of whether they can or should exercise "substantive" powers of review. This reluctance is understandable. On the one hand, the idea of "substantive" review presents difficult issues about the relation between agencies and courts, and the nature of the congressional mandate in NEPA. On the other, "procedural" review techniques have frequently had the practical effect of causing agencies to make significant changes in programs and projects, so that it may have seemed unnecessary for courts to reach the question of the existence or nature of a substantive review power. 18

This judicial reluctance to reach substantive issues has led some commentators to announce the "death" of the idea of NEPA as a body of substantive principles constraining agency decisions and enforceable by the federal courts. 19 However, this report of the "death" of NEPA's substantive mandate may be premature. In the first place, some federal judges have continued to adhere to the doctrine of substantive review, at least in theory. 20 More significantly, the exclusive concern with judicial review and reliance on the courts initially to develop a substantive law of environmental policy may have focused attention in the wrong place. For if NEPA has a substantive mandate, the burden of interpreting it, and of developing more specific principles of environmental policy law from the general language of NEPA should fall in the first instance on the agencies themselves. It is at least arguable that if the agencies accept such responsibilities, they may be a primary source of the substantive principles commentators have hoped for. If this is the case, agency decisions could serve as a basis for a substantive set of rules and principles which could subsequently be corrected, refined, and developed by the judiciary, with deference to agency expertise only where this seems consistent with NEPA's structure and intent.

Thus, cases like Indian Point Two have a special significance. Not only does that case reflect agency recognition of substantive duties under NEPA; it also contains principles that could guide the construction of a general law of environmental policymaking. That is why it is important to understand the complex issues presented and resolved in this controversy.

III. NEPA's Requirements

NEPA's Title I establishes a national environmental policy and

346, 353 (8th Cir. 1972); Environmental Defense Fund, Inc. v. Corps of Eng'r's of the United States Army, 470 F.2d 289, 300 (8th Cir. 1972), cert. denied, 412 U.S. 931 (1973). For a general review of judicial intervention under NEPA, see LIROFF, supra note 4, at 160-65.
19. See LIROFF, supra note 4, at 186-88.

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imposes specific duties on federal agencies.\textsuperscript{21} Declaring that "it is the . . . policy of the Federal Government . . . to create and maintain conditions under which man and nature can exist in productive harmony,"\textsuperscript{22} Congress announced that it is the responsibility of the federal government to use all practicable means, consistent with other policies, to preserve environmental amenities, assure "safe, healthful, productive, and esthetically and culturally pleasing surroundings,"\textsuperscript{23} and "attain the widest range of beneficial uses of the environment without degradation . . . ."\textsuperscript{24}

In addition to these and other broad statements of policy, Title I also contains a number of "mandate expanding" and "action forcing" aspects.\textsuperscript{25} Thus, the statute includes a specific requirement that agencies add environmental concerns to their existing legislative mandate. Section 102 states that, to the fullest extent possible, "the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act . . . ."\textsuperscript{26}

Further, Section 102 outlines specific procedures by which environmental concerns are to be incorporated into agency decisional processes. This section includes requirements for interdisciplinary analysis and techniques for insuring "that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations."\textsuperscript{27} Moreover, Section 102(2)(C) requires that all recommendations for major federal actions significantly affecting the environment must be accompanied by a detailed statement on the environmental impact of the action.\textsuperscript{28}

The environmental impact statement (EIS) must identify the environmental impact of any "major federal" action, and must specify any adverse effects which are unavoidable should the project be implemented.\textsuperscript{29} Additionally, the statute requires identification of alternatives to the proposed action, clarification of the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity,"\textsuperscript{30} and identification of any "irreversible and
irretrievable commitments of resources which would be involved in the proposed action should it be implemented.31 Finally, the statute indicates that other federal agencies should be consulted before a detailed statement is completed.32

Although the Act makes it clear that an EIS is to be comprehensive, and that it is to be a vehicle for interagency comment, it is silent on many aspects of the EIS process. For example, the statute gives no explicit guidelines on the weight agencies should give to environmental values. While it is clear that these must be identified, NEPA does not explicitly state what are the nature and extent of an agency’s obligations to modify activities that are shown to have adverse environmental impacts. These were the questions that were addressed in Indian Point Two.

IV. THE NRC LICENSING PROCESS AND NEPA

A. NRC Licensing Process

Indian Point Two involved a request for an operating license by Consolidated Edison of New York (Con Edison) for its second nuclear plant at Indian Point on the Hudson River. Before construction or operation of a nuclear power facility, an applicant must first obtain a construction permit and an operating license from the NRC. Before the Commission may issue such licenses it must find that the construction and operation of such a facility will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public.33

After initial staff review of an application and preliminary approval by the Advisory Committee on Reactor Safeguards, notice of the application is given to appropriate officials and the general public.34 A hearing may be required35 over which either members of the Commission, an atomic safety and licensing board, or other officers may preside;36 unless otherwise ordered by the presiding officer the applicant has the burden of proof.37 On determining that an application meets the requirements of the Act and the regulations of the Commission, a license will be issued containing such conditions as are deemed appropriate and necessary.38 Initial decisions, which must contain findings of facts and conclusions of

35. The Atomic Energy Acts provide that a hearing is required upon the request of any person whose interest may be affected by a decision or in any proceeding concerning an application for a construction permit. 42 U.S.C. § 2239(a) (1970).
37. Id. at 10 C.F.R. § 2.732.
law, are appealable to the Atomic Safety and Licensing Appeal Board. 39

Upon completion of the construction or alteration of a facility in compliance with the terms and conditions of the permit, the Commission will issue an operating license in the absence of good cause shown to the contrary. 40 If a hearing is held in regard to the issuance of such license, the Commission may authorize a license for operations short of full power operations. 41 All final decisions are appealable to the courts under the Atomic Energy Act. 42

B. NEPA Under the NRC

Under NRC rules an EIS must be prepared and circulated prior to the issuance of a construction permit, the issuance of a full-power license to operate a nuclear power reactor, and the conversion of a provisional operating license to a full-power license where no final EIS has been previously prepared. 43 An applicant for a construction permit must file an environmental report containing a cost-benefit analysis which considers and balances the environmental effects of the facility and its alternatives and quantifies the various factors involved to the fullest extent practicable. 44 An applicant for an operating license must discuss the same matters to the extent they differ from those previously discussed or reflect new information. 45 The agency staff then prepares and circulates a draft EIS which includes a staff preliminary cost-benefit analysis similar to that contained in the environmental report. 46 The staff's cost-benefit analysis must include quantification of the various factors to the extent practicable, and discussion of other factors in qualitative terms. 47 After circulation of and the receipt of comments upon the draft EIS, a final EIS is prepared and circulated which must accompany the application through the Commission's review process. 48 This statement must include a final cost-benefit analysis and a final conclusion as to the action called for. 49

In proceedings in which a hearing is held, an initial decision of the presiding officer may include findings and conclusions which affirm or modify the final EIS. 50 Further, the presiding officer must independently consider the final balance among conflicting factors contained in the

41. Id. at 10 C.F.R. § 50.57(c); Nuclear Reg. Comm’n, Licensing and Regulatory Policy and Procedures for Environmental Protection, 10 C.F.R. § 51.53 (1977).
44. Id. at 10 C.F.R. § 51.20(a), (b).
45. Id. at 10 C.F.R. § 51.21.
46. Id. at 10 C.F.R. §§ 51.22, 51.23.
47. Id. at 10 C.F.R. § 51.23(c).
49. Id. at 10 C.F.R. § 51.26(a).
50. Id. at 10 C.F.R. § 51.52(b)(3).
record and determine, after weighing the environmental, economic, technical, and other benefits against environmental and other costs, and considering available alternatives, whether the permit or license should be issued, denied, or appropriately conditioned to protect environmental values.\textsuperscript{51}

However, in a proceeding upon an application for an operating license, the applicant may petition for a temporary operating license after the NRC staff has prepared a final detailed statement on the environmental impact of the action, and such a license may be granted before the EIS is complete provided that the Commission finds that the operation of the facility during the period of the temporary operating license will provide adequate protection of the environment during such period.\textsuperscript{52}

Thus, NRC rules insure the collection and consideration of environmental factors in the decisionmaking process. Further, the rules require a cost-benefit analysis of the proposed action with environmental factors taken into account in quantified form when available. They authorize the presiding officer to issue, deny, or "appropriately condition" the license, "to protect environmental values,"\textsuperscript{53} but they give no guidance on when such denial or conditioning is "appropriate." Specifically, the regulations do not specify the appropriate methodology to be used in quantifying environmental values nor indicate how much weight the decisionmaker should give to non-quantifiable values. Also, the rules fail to give guidance to decisionmakers in cases in which there is uncertainty about the extent of environmental harm should the construction or operation of a nuclear facility be approved.

\textbf{C. The Problems of Uncertainty and Unquantified Values}

These two omissions place a substantial burden on agency decisionmakers. In many cases the environmental effects of a given decision may be uncertain. Predictions of whether a project may cause environmental harm can depend on technical or scientific data which does not exist, or about which there is substantial controversy, or both. Where this is the case, decisionmakers must assess the likelihood of such harm before they can consider whether the harm warrants denial or conditioning of the requested license. Moreover, before decisionmakers can decide if predictable environmental damage warrants denial of a license, they must determine the relation between the amount of predictable environmental harm and any other benefits to be derived from the project. Further, before considering any modification of a license—such as a condition requiring environmental protection measures—the decisionmaker must weigh the benefits of protection against its cost. To the extent that

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\item \textsuperscript{51} Id. at 10 C.F.R. § 51.52(c).
\item \textsuperscript{52} 42 U.S.C. § 2242 (Supp. V 1975).
\item \textsuperscript{53} Nuclear Reg. Comm'n, Licensing and Regulatory Policy and Procedures for Environmental Protection, 10 C.F.R. § 51.52(c)(3) (1977).
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environmental harms or non-environmental benefits cannot be quantified, this assessment is made extremely difficult, since the variables on each side of the equation are not comparable. Moreover, the problem is compounded when both uncertainty and non-quantifiability are present in the same case. This was the situation in *Indian Point Two*.

In dealing with this problem the NRC had little to guide it. As has been noted, the agency’s regulations were silent on these questions. Moreover, other sources of NEPA interpretation are similarly silent on those issues. Although the Council on Environmental Quality guidelines encourage quantification and consideration of non-quantifiable values,\(^{54}\) like the NRC’s rules they say nothing about the problem of uncertainty or the weight to be given to non-quantified values. Nor have the courts developed principles that would help decisionmakers confronted with uncertainty and the comparison of quantified and non-quantified factors. The courts have indicated that NEPA must be construed by a “rule of reason”\(^{55}\) which limits the information an agency must collect in order to compile an adequate EIS to that which is reasonably available.\(^{56}\) But the cases do not say what, if anything, an agency must do when, through reasonable efforts, it has collected evidence showing that substantial environmental harm is possible but not certain.

Thus, when the NRC in *Indian Point Two* confronted the twin problems of uncertainty and non-quantifiability, and attempted to interpret its obligations under NEPA in such conditions, it was breaking new legal ground. Moreover, given the likelihood of judicial deference to its resolution of these thorny issues, it was also assuming the primary responsibility for defining the nature of NEPA’s substantive mandate.

V. *INDIAN POINT: ALLOCATING THE BURDEN OF UNCERTAINTY*

A. *Background*

In the early 1960’s Con Edision built its first nuclear power facility at Indian Point on the Hudson River. Criticism of the facility grew as evidence mounted that it was harming fish. When the utility requested an operating license for its second Indian Point unit, environmental groups, encouraged by recent passage of NEPA and the strong language of *Calvert Cliffs’*,\(^{57}\) saw the Indian Point Two licensing proceeding as an


\(^{57}\) Calvert Cliffs’ Coordinating Comm., Inc. v. United States Atomic Energy Comm’n, 449 F.2d 1109 (D.C. Cir. 1971).
opportunity to mount a challenge to the utility’s development program. Some, concerned with nuclear safety, wanted the plant shut down. Others, concerned more with harm to aquatic life, asked that the plant be redesigned to minimize environmental damage. The effort to stop the number two reactor for safety reasons failed. The effort to secure redesign to protect the fishery succeeded to a significant degree.

The design feature objected to was the plant’s cooling system. All power plants that generate electricity through steam need systems to cool the steam condensers; thus, they must draw large volumes of cool water into the plant and discharge equal volumes of heated water. Nuclear plants discharge more heat per kilowatt of energy generated than conventional plants, thus increasing the need for water.

When a generating plant is cooled by drawing water from a lake or river, the plant can have a substantial impact on aquatic life. First, the process of drawing the water into the plant may harm fish who are caught on screens that surround the intake pipes—called impingement—or harm organisms that pass through the screens and are drawn through the plant itself—called entrainment. Second, thermal pollution caused by the discharge of heated waters into the river or lake may harm aquatic life. 58

The Indian Point Two plant was originally designed with an open-cycle cooling system which removed water from the Hudson, ran it through the plant, and discharged the heated water back into the river. Substantial fish loss through entrainment and impingement was thus feared. Therefore, the environmental intervenors sought to have a closed-cycle cooling system required before a license for full power operation of the plant was granted. A closed-cycle system recycles water within the plant, substantially reducing its impact on aquatic life. However, a closed-cycle cooling system is expensive, requiring the construction of costly towers. Further, the use of the towers for cooling reduces the power output of a plant and increases annual generating costs. 59

In order to decide what to do about cooling towers, the NRC had to resolve factual problems about the nature of the Hudson River fishery and technical issues about the level of harm the existing open-cycle system was doing. Further, the NRC had to make decisions without complete information on these matters. Moreover, there were a number of alternative outcomes that could be selected; these ranged from a decision to allow the plant to operate as originally designed to an immediate order to construct a specific type of tower.

58. See generally Bush, Welch, & Mar, Potential Effects of Thermal Discharges on Aquatic Systems, 8 Env'tl Sci. & Tech. 561 (1974); Clark, Thermal Pollution and Aquatic Life, 220 Scientific Am. No. 3 at 18 (March 1969). See also Nuclear Reg. Comm'n, Final Environmental Statement Related to Operation of Indian Point Nuclear Generating Plant Unit No. 3, vol. 1, § V, 101-11 (Feb. 1975) [hereinafter cited as Environmental Statement].

59. See Environmental Statement, supra note 58, at vol. 1, § XI, 60-74.
B. The Decision

The principle environmental issue at the hearing before the Licensing Board concerned the impact of the open-cycle cooling system on the fish population of the Hudson River through entrainment and impingement. The parties disagreed sharply on the total effect of the plant on fish in the Hudson and in the Atlantic into which the river feeds. Most attention was given to the impact on striped bass, the species which had the greatest commercial and sports fishing value. At the hearing, Con Edison, the environmental intervenors, and the NRC staff each produced its own study of the impact on the bass.

A number of major issues were involved in estimating the effect the open-cycle cooling system would have on the striped bass population. One issue concerned the percentage that would be killed of the eggs, larvae, and young juveniles passing through the plant. The NRC staff and the environmentalists argued that all such organisms passing through the plant would be killed, while Con Edison argued that the figure would certainly be less than that. No study had been completed on this issue although Con Edison was undertaking this research at another of its plants. The Board stated that because of the large uncertainties involved an assumption that one hundred percent of the entrained organisms would be killed was an appropriately conservative estimate.

A second issue at the hearing concerned estimating the total number of organisms that could be expected to be entrained. Such estimates involve the use of complex mathematical models to account for such factors as the distribution of organisms at different depths, diurnal movements of the organisms, and the ebb and flow of the tide. Because of the different models used by the parties, they came up with widely differing figures. Con Edison sought to account for some of its predictions by the use of certain factors—called "f" factors—in its model whose assigned values of less than one reduced the predicted effects. These "f" factors sought to account for a non-uniform distribution of the different life stages of the fish and the concentration of organisms near the intake flow in relation to the average concentration of the organisms in the river. The Board stated that Con Edison had some justification for its "best" estimate in the range of estimates it provided and admitted that if the staff's predictions were wrong, they may have overestimated the effects by as much as one hundred percent. Nevertheless, the Board held that an appropriately conservative figure for the "f" factors was one.

A third issue in the controversy concerned Con Edison's use of a

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61. Id. at 762-63.
62. Id. at 762-66.
63. Id. at 765.
64. Id.
compensation principle in its predictions. This principle hypothesized that the fish population would not decrease in a downward spiral as any reduction in fish density operated to increase the survival rate among fish in the less dense environment. The staff rejected this principle as not having much effect and argued that the size of the fish population was primarily governed by fishing exploitation. The Board’s finding was that the applicant had produced no convincing evidence that the reduction in the plant’s impact because of compensation was as great as the applicant predicted.65

A final, major issue concerned estimating the contribution that striped bass from the Hudson made to the Mid-Atlantic bass fishery. Based on tagging studies and commercial catch data, the NRC staff argued that the Hudson contributed eighty percent of the population of the fishery while Con Edison argued that the Hudson’s maximum contribution was ten percent.66 The greater the Hudson’s contribution to the Mid-Atlantic fishery the greater the effect would be of any adverse impact from the power plant. The range of estimates on the principle issue is reflected in figure 1.

Values placed on the monetary impact of an open-cycle cooling system ranged widely, from Con Edison’s estimate that the annual value of the loss would be as low as $740 thousand to the environmentalists’ estimate that damage would be in the vicinity of $13 million per year. The Board, having accepted no parties’ position per se, concluded that the monetary impact on the fishery would range from $1.4 million to $5.6 million annually.67 The Board also found that the cooling towers would cost $16 million per year.68 The Board stated that, “the benefits, to the extent they can be quantified, to be derived from installation of a closed-cycle cooling system on Unit No. 2 are unlikely to approach the cost.”69 Yet the Board recognized that unquantifiable benefits must be given due weight. In fact, reasoned the Board, NEPA, “requires that a natural resource like the Hudson River fishery be protected from serious damage if economic means having less adverse environmental impact are available to provide such protection.”70

Based on this interpretation of its obligations under NEPA, the Board granted the license but conditioned its issuance on a requirement that Con Edison have a closed-cycle cooling system in operation by May 1, 1978.71

65. Id. at 765-66.
66. Id. at 768-69.
67. Id. at 770-71.
68. Id. at 775.
69. Id. at 782.
70. Id.
71. Id. at 782-83.
Both the utility and the environmental intervenors appealed. On appeal, the Appeal Board stressed that NEPA merely required that environmental factors be weighed in the decision process and balanced against other values.\textsuperscript{73} In turning to the facts of the case, the Appeal Board overruled many of the Licensing Board's factual findings, holding that the staff and intervenors had not met their burden of proof on several

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\textsuperscript{72} For the data from which this graph was composed, see \textit{id.} at 764, 766, and 769.

\textsuperscript{73} In re Consol. Edison Company of N.Y., Inc. (Indian Point Station, Unit No. 2), 7 A.E.C. 323, 344-45 (April 4, 1974).
crucial issues. The Appeal Board found that the record did not support the staff’s position on the magnitude of the Hudson River’s contribution to the coastal fishery, the staff’s or the intervenor’s position on the number of eggs, larvae, or young juveniles that would be entrained, or the staff’s analysis of the compensatory effect of the destruction of young fish which was adverse to the applicant’s position.74

The Appeal Board did apparently concede, however, that its “balancing” view of NEPA notwithstanding, values protected by NEPA may not be amenable to weighing in a strictly quantified cost-benefit analysis. Despite the lower Board’s finding that, insofar as the costs and benefits connected with the project were quantifiable, the cost of building the towers outweighed the benefits of doing so, and despite its own findings that significant elements of the environmentalists’ case were missing, the Appeal Board nevertheless ordered the company to build closed-cycle cooling towers. The Appeal Board did, however, extend the date for operation of the cooling towers to May 1, 197975 subject to extension on two conditions: (1) if the construction could not be completed on time, an extension would be allowed “for good cause”76 and (2) if the utility was able to adduce additional empirical data in the interim through its proposed research program justifying a further extension, it could apply to the Commission for such extension.77 Further, the cooling tower requirement could presumably be dropped altogether should new evidence bear out Con Edison’s predictions that environmental damage from open-cycle cooling would be relatively slight.

As a result of subsequent proceedings, as of the date of this writing, the specific type of cooling tower to be built has been agreed upon;78 however, the termination date for the use of the open-cycled cooling system had been further postponed because of the delay incurred in deciding this issue.79 Further, Con Edison has now completed its research program and has asked for an amendment to its license striking the condition that a closed-cycle cooling system be built80 and for an indefinite postponement of the termination deadline while the NRC decides whether to grant or deny the amendment.81

These new proceedings may lead the NRC to reconsider specific questions of fact, based on new research findings. But Con Edison’s

74. Id. at 406.
75. Id. at 406-07.
76. Id.
77. Id. at 408.
78. By stipulation, the parties agreed upon a natural draft, wet cooling tower. See In re Consol. Edison Co. of N.Y., Inc. (Indian Point Station, Unit No. 2), LBP-76-43, 1976 NRC ISSUANCES 598 (Nov. 30, 1976).
80. Id. at 14-15.
81. Interview with Ms. Sarah Chassis, representing the Hudson River Fishermen’s Assoc., in New York City (June 7, 1977).
motions do not appear to challenge the basic rationale of the original decision that cooling towers were required on the data then available. What, then, was the reasoning behind that decision?

There are, as have been noted, ambiguities and even possible inconsistencies in the Appeal Board decision. Nevertheless, by upholding the Licensing Board’s decision to condition the license on construction of the cooling towers, the Appeal Board seemed to affirm the original panel’s interpretation that such a measure was mandated by NEPA. On the facts of the case, this decision amounted to a rule that the burden of environmental uncertainty was on the applicant, and that in this case the applicant had failed to meet this burden. This interpretation of the Appeal Board decision is confirmed when we examine its principle modification of the original panel’s order—the qualification that the deadline for cooling tower construction could be extended if the utility’s research program adduced new data that would confirm its original position that the harm was lower than the several NRC estimates. This qualification suggests that the Appeal Board recognized that if the uncertainty was reduced, the decision that NEPA required cooling towers at Indian Point Two might be reversed.

In conclusion, then, Indian Point Two stands for the proposition that NEPA may, in appropriate circumstances, require the Agency to allocate the burden of environmental uncertainty to the applicant in a licensing proceeding. In general terms, the case holds that where sufficient evidence has been adduced that a proposed plant may cause environmental harm, and that cost-justified protective measures exist, the agency must require the protective measures unless and until the applicant can demonstrate that the harms are not probable and/or the costs of protection are excessive.

This rule would be consistent with the Commission’s general rule on burden of proof in licensing proceedings, which holds that the burden is on the applicant. But at the same time it constitutes an important gloss on that rule. Prior to NEPA, when the NRC’s predecessor agency had no environmental obligations, proof on matters of harm and prevention were

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82. The ambiguities noted were exacerbated by a subsequent Appeal Board decision, In re Consol. Edison Co. of N.Y., Inc. (Indian Point Station, Unit No. 3), [1975] 2 NUCLEAR REG. REP. (CCH) ¶ 30,004.02 (Sept. 3, 1975) in which the Board seemed to state that it had never required the use of a closed-cycle cooling system in Indian Point Two but rather that the question had been left open. However, on appeal, the Nuclear Regulatory Commission interpreted the Appeal Board’s Indian Point Two decision as requiring closed-cycle cooling in the absence of an application to amend the operating license as a result of new empirical data. See In re Consol. Edison Co. of N.Y., Inc. (Indian Point Nuclear Generating Station, Unit No. 3), [1975] 2 NUCLEAR REG. REP. (CCH) ¶¶ 30,027.02, 30,027.03 (Dec. 2, 1975).

83. Nuclear Reg. Comm’n, Rules of Practice, 10 C.F.R. § 2.732 (1977). See also In re Consol. Edison Co. of N.Y., Inc. (Indian Point Nuclear Generating Station, Unit No. 3), [1975] 2 NUCLEAR REG. REP. (CCH) ¶¶ 30,027.02, 30,027.04 (Dec. 2, 1975), in which the NRC stated that the applicants’ burden of justifying any amendment to the operating license for Indian Point Two must be met by a preponderance of the evidence.
not necessary elements of a licensing application. *Indian Point Two* demonstrates that NEPA changes the essential elements of a successful application, and thus confirms the conclusion that NEPA expanded the agency’s substantive obligations. 84

C. Detailed Analysis

The question remains, however, as to the nature of the threshold data that must be adduced before the burden of uncertainty should be allocated to the applicant. Surely, if there is no evidence that a plant will cause harm, or that it will cause at most trivial harm which can be corrected only at substantial cost, Indian Point Two would not require a conditional permit. Thus the issue emerges: What was the data that supported the decision to require the cooling towers, and what analytical process did the agency use to determine that the burden should be allocated to Con Edison? This issue was clearly joined, because Con Edison argued that the data introduced by the NRC were insufficient to justify a finding that cooling towers were required. The Agency rejected this argument, but because the opinions are not clear as to why, further analysis of the facts of the case and the Agency’s apparent rationale is necessary. In this section basic economic concepts are used to develop a framework that can explicate this rationale.

In *Indian Point Two* the data available and accepted by the NRC were sufficient to show that some damage would be caused by the plant and that much of this damage could be avoided by requiring cooling towers. The cost of the cooling towers was known. Moreover, the data made it possible to identify the worst possible form of damage that could occur. But there was no way to quantify the losses that would occur if this worst case occurred, or to estimate the probability of its occurrence.

Figure 2 illustrates the Licensing Board’s findings on the costs and quantifiable benefits of protecting the striped bass.

**Figure 2**

(millions of dollars per year)

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate of quantifiable loss to striped bass fishery (QB)(^{85})</td>
<td>1.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Cost of protection (towers) (C(_P))(^{86})</td>
<td>16.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Quantified Net Cost (C(_P) - QB)</td>
<td>14.6</td>
<td>10.4</td>
</tr>
</tbody>
</table>

84. That NEPA expanded the NRC’s substantive mandate has been specifically recognized in a number of licensing cases since *Indian Point Two*. See, e.g., In re Kansas Gas &
The Board recognized that the cost of the towers would be greater than its own estimate of the largest possible quantifiable loss to the striped bass fishery. Nevertheless it concluded that NEPA required that the cooling towers be constructed. Since it assumed that this would only be the case if the benefits of environmental protection outweighed the costs of the towers, the Board apparently believed that it had before it sufficient data to justify a finding that Indian Point Two would, either alone or through the cumulative effects of building yet another power plant on the Hudson, do at least $10.4 million in damage over and above the estimate for quantifiable losses to the striped bass fishery. That is, unquantified benefits were greater than the quantified net costs. Why did the Board feel this conclusion was mandated?

The explicit discussion of this point is brief and unclear. The Licensing Board admits that, using the losses that can be quantified and the known cost of environmental protection, the benefits of protection are unlikely to approach the costs. That is, even on the highest estimate of quantified damage, the costs of the towers will be larger than the monetary loss. But, the Board went on, NEPA "requires that a natural resource like the Hudson River fishery be protected from serious damage if economic means having less adverse environmental impact are available to provide such protection." The Board found that Indian Point Two had the potential for causing serious long-term damage to the fishery, and noted that the NRC staff considered the fishery a "priceless resource." It further observed that the cooling towers would remove the potential for such damage. On this reasoning it concluded that the cooling towers must be built.

The key issue is what the Board meant by "economic means." The Board apparently contemplated that the decision required a comparison of the costs and benefits of environmental protection itself. Such an analysis treats the elimination of an environmental harm as a benefit, and compares this with the cost of protective measures that will eliminate or substantially reduce the harm. If the amount of damage is certain and quantified, the benefits are clear. And if the protective measures can be accurately costed, it is easy to determine if a measure is "economic" in this sense; all one needs to do is compare benefits with costs, and require all protective measures for which the ratio is greater than one. Thus the opinion can be read as holding that environmental protective measures are required under NEPA if they are cost-justified in this sense.

Electric Co. and Kansas City Power & Light Co. (Wolf Creek Nuclear Generating Station, Unit No. 1), [1975] 2 NUCLEAR REG. REP. (CCH) ¶ 30,061.01 (Apr. 7, 1976); In re Detroit Edison Co. (Greenwood Energy Center, Units 2 and 3), 8 A.E.C. 936 (Dec. 20, 1974). These two cases both held that the NRC has the power to condition construction permits so as to minimize environmental harm just as it may impose conditions for safety purposes.
86. Id. at 775.
87. Id. at 782.
But what is the meaning of such a rule in cases where "benefits" are not clear? As has been noted, and Indian Point Two illustrates, it is frequently the case that the extent of environmental harm from a project is unknown. Moreover, even when harm is known it may be hard to quantify the damage that will be done. Thus, even when protection costs are clear it may be hard to know whether the benefits of protection, that is, the harms eliminated, are greater than the cost of the protective measures. That was the dilemma facing the NRC in Indian Point Two.

There are a number of ways one might deal with this situation, and these approaches suggest how the "cost-justified" rule can be employed in situations of uncertainty as well as in cases where all harms are known and quantified. First, it may be possible to identify the range of environmental harm. That is, while it may be impossible to say with certainty what harm will occur if a project is built, or built without protective measures such as cooling towers, one may be able to say that the harm will be no less than X (best case) and no greater than Y (worst case). Further, even if all the benefits of a protection measure (harm prevented) cannot be quantified, it may be possible to quantify some and identify the others. Once this is done, however, the problem arises as to how to compare these best and worst case estimates, as well as the quantified and unquantified benefits, with the costs of the protective measures.

The first issue is how to deal with the range of estimates. Should one use the best or worst cases, or even an intermediate case? Unless one has reliable data on the relative probabilities of these "cases"—a rare occurrence, certainly—there is no clear answer to this issue. Further, what weight is to be given to unquantified benefits? If we know that a measure will provide some environmental benefits but we can't quantify all of them, when will the measure be "economic"? Finally, how do we relate these two factors—uncertainty and unquantifiability?

There are a variety of approaches that can be taken to these problems. The first would be to ignore unquantified benefits but accept the most pessimistic estimates of the nature of the damage done. This would mean using the worst case estimates of harm, but only calculating the benefits that can be quantified. In this approach one would require a protective measure as long as the quantified benefits under the worst case estimate of the nature of the harms caused by the project exceed the protection costs. The argument against this approach is twofold. On the one hand, it is insensitive to the probabilities of the several "cases." If the worst case is highly improbable, this approach could justify expensive protection against remote risks. On the other hand, this approach is insensitive to the relation between the quantified benefits (QBs) and the unquantified benefits (UQBs). If the UQBs are likely to be high, but the range of impacts between best and worst case is small, this approach could support a decision not to take protective measures which might yield large, albeit unquantifiable environmental benefits. The latter result
would be inconsistent with NEPA’s mandate to consider unquantified environmental values, while the former would violate Calvert Cliffs’ call for finetuned balancing.

Another approach would raise similar problems. In Indian Point Two, the utility argued that the Licensing Board had actually reached its decision by acting on the assumption that the worst case damage estimate would occur, and required protection because it believed that the costs of protection were less than the highest possible estimate of the sum of quantified benefits and the dollar value of benefits not specifically quantified.\textsuperscript{88}

The Appeal Board agreed with the utility’s argument that such a test, if employed, would not be consistent with the Calvert Cliffs’ notion of “finely tuned and systemic balancing.”\textsuperscript{89} It said that a rule of reason must be used to arrive at “the most reasonable expectation as to the predicted environmental effects of a proposed course of action.”\textsuperscript{90} However, the Appeal Board did not accept Con Edison’s contention that the Licensing Board had erred in its analysis. The Appeal Board, while recognizing that the Licensing Board’s decision was unclear, decided that the decision rested on application of an appropriate rule of reason.\textsuperscript{91} The Appeal Board agreed with the Licensing Board’s decision, although it did question some of the Licensing Board’s findings and did modify the deadline for installation of closed-cycle cooling.\textsuperscript{92}

None of the three NRC decisions—those of the staff, the Licensing Board, or the Appeal Board—contains a clear statement of the decision process that was followed. All agreed that there were benefits from the towers that could not be quantified, so that the quantitative figures for any estimated degree of impact would understate the total social benefits from protection. In addition, all agreed that NEPA required that these benefits be taken into account, and all recognized that the tasks involved determining the appropriate risk preference and the probabilities of environmental damage, and estimating the amounts to be attributed to unquantified benefits (damage).

But what procedures are to be followed to do this? It is the contention of this Note that the NRC in Indian Point Two did develop a procedure that would permit this type of decision to be made. Moreover, it is contended that this approach comports with NEPA’s substantive mandate, as interpreted by Calvert Cliffs. However, none of the opinions in the case explicitly set forth the procedures that seemed to have been

\textsuperscript{88} In re. Consol. Edison Co. of N.Y., Inc. (Indian Point Station, Unit No. 2), 7 A.E.C. 323, 348-56 (Apr. 4, 1974).
\textsuperscript{89} Id. at 350-53.
\textsuperscript{90} Id. at 358.
\textsuperscript{91} Id. at 360-61.
\textsuperscript{92} Id. at 405-07.
followed. To understand them, therefore, it is necessary to try to reconstruct what was actually done.

These procedures can be reconstructed through careful analysis of the various NRC documents, including the impact statements and the two opinions. This analysis is confirmed by comparing it with the Final Environmental Impact Statement prepared by the NRC for Indian Point Three, where the staff explains in greater detail its rationale for requiring cooling towers to be built unless the utility can prove that they are not necessary.93

The first part of the process requires use of quantified environmental benefits and the costs of the protection measures. The process seems to have involved the following steps:

1. Determine all possible impacts of the plant on the environment.
2. Identify the range of impact that is possible.
3. Quantify the loss to the environment from this range of impacts, which will yield high and low quantifiable benefits from environmental protection (QB).
4. Compare these figures with the costs of eliminating the damage ($C_p$).

All these steps are clearly mandated by Section 102(C) of NEPA, which calls for a detailed environmental impact statement,94 and by the CEQ guidelines and NRC rules on preparing such statements.95 Moreover, the NRC seems to have interpreted NEPA's substantive mandate as requiring that protective measures be taken at least if this analysis shows that the quantified environmental benefits (damage eliminated) exceed the protection costs (the "cost-justified rule"). This interpretation is consistent with NEPA's requirements that agencies consider alternatives to proposed action96 and that federal policy should seek to attain "the widest range of beneficial uses of the environment."97

The analysis outlined above is sometimes referred to as "sensitivity" analysis.98 This is a technique used in business and operations research to determine if the outcome of a decision is sensitive to variation in a factor about which information is uncertain. Since the NRC believed that it must require the towers if and only if they were cost-justified, it had to know if the decision depended on data it lacked. Had the cost of

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93. See generally ENVIRONMENTAL STATEMENT, supra note 58.
the towers been less than the quantified benefits on the low estimate, the
decision would be "insensitive" to any variation in the unquantified
damage factor. But this was not the case. Therefore, the uncertain and
unquantified data becomes important to the decision.

The NRC had to determine how to apply the "cost-justified rule" when uncertain impacts and unquantified benefits have to be taken into
account. This means that a more discrete analysis of the existing data
becomes crucial. Among the factors that might clarify the decision are:
the possible magnitude of unquantified benefits, the weights to be given
to different types of possible harm, the likelihood of specific harms to the
extent this can be estimated, and the possibility of securing further data
before final decisions to build a project or a protective device must be
made.

One technique that can be used to inform a decision in these circum-
stances is to identify the gap between quantified benefits and costs. Where some but not all benefits can be quantified, this type of analysis
permits us to determine the minimum amount that the unquantified
benefits must equal before the project would be cost-justified. With this
figure we can tell how much society is paying to secure unquantified
benefits. Moreover, if we have separate estimates for the best and worst
case damage estimates, this procedure will tell us how much we are
spending to insure against the worst case eventuality.

This analysis will not lead to a definite conclusion. It will show that
the unquantified benefits must equal $X before the project will be cost-
justified on the best case, and $Y on the worst case assumption. But it
cannot tell us whether such an investment in protecting unquantifiable
environmental amenities is justified, or whether any additional invest-
ment to insure against the worst case is desirable. To decide that issue, it
is necessary to include specific values or preferences in the equation.

NEPA contains principles that can fill in the remaining gaps. By
using these principles it is possible to develop "weighting" rules to
handle imperfect data of this type. It appears such rules were used in
Indian Point Two. If fully understood and developed, these rules can not
only explain that decision, they can also be used by decisionmakers in
other cases involving the question of whether NEPA requires expendi-
tures to install a specific protective measure or otherwise eliminate
possible environmental harm.

The first of these principles is the policy of avoiding "irreversible
and irretrievable commitments of resources." 99 NEPA specifically re-
quires that an EIS explicitly identify any such possibilities, 100 as well as
consider the relationship between short-term uses of the environment and

100. Id.
the maintenance of long-term productivity. The fact that Congress specifically called for data on these issues, when read in light of the general statements of policy in Section 101 which require the federal government to "fulfill the responsibilities of each generation as trustee of the environment" and "enhance the quality of renewable resources," suggests a specific mandate to avoid any irreversible action that could deplete a non-renewable natural resource.

From this mandate it would follow that actions which would avoid such irreversible damage to non-renewable resources should be given special weight in any fine-tuned balancing. This weighting would affect both the evaluation of non-quantifiable benefits, and determination of the significance of uncertainty. Where a possible impact of a project is such an irreversible impact on a non-renewable resource, this analysis would argue for requiring protection even if the gap between quantified benefits and protection cost is quite high. And it would similarly support substantial investments in protection to eliminate even an uncertain "worst case" if that case included such an irreversible process.

A second principle can be derived from NEPA's basic mandate to secure all available information about the environmental impact of projects, and its requirement that agencies take measures to ensure "that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking." These requirements would suggest that any measure which would increase information about environmental impact, especially in cases where there are substantial unquantified possible environmental benefits, should be given special weight.

From the principle that additional environmental information should be valued we can derive several sub-principles. First, preference should be given to any measures which will reduce the cost of additional information. This would include policies which encourage the production of needed information at the lowest cost, and measures which would reduce the cost of making decisions which must be made under conditions of uncertainty. Secondly, the principle would support preference for policies which make additional information unnecessary.

There are a number of policies that will reduce the cost of information. One is to ensure that the burden of producing information is borne by the party which can produce needed information at the lowest total

cost. This policy would suggest that in licensing proceedings the burden of producing information should normally fall on the applicant. The applicant will have more experience with the proposed activity than the agency, and thus should be in the best position to develop new data about its environmental activities. This does not, of course, mean that the applicant will always be the "least-cost information provider," or that the agency can rely exclusively on the applicant's data, which may be biased. Moreover, the distributional implications of placing the burden on applicants might modify the general principle. It does seem clear, however, that measures which place the responsibility on the applicant to produce additional data when decisions are sensitive to uncertainty and unquantifiability should normally be given a heavy weighting in agency decisions and policies.

Further, the principle of reducing information costs should also lead agencies to favor measures which can be reversed if new information is developed. In many cases it will be necessary for agencies to make decisions under conditions of uncertainty. In these circumstances, measures which will reduce the cost of a wrong guess should be given heavy weight. For example, if an agency decides to require protective measures which might, with further information, prove not to be cost-justified, measures which can be terminated if new data appears should be preferred to those which are irreversible.

Finally, policies which reduce the need for information should be preferred. Thus, there may be alternative ways to design projects. If one alternative will eliminate possible environmental harm while the other creates the possibility but not the certainty of damage, ceteris paribus the first alternative should be preferred. In licensing context this principle should lead agencies to favor measures which place the burden of uncertainty on the applicant. Since the licensee has control of the design of the project, allocating the burden of uncertainty to the applicant should normally encourage applicants to make basic design decisions that reduce the need for production of expensive data about environmental harm.

Analysis of the decision in Indian Point Two suggests that the NRC was influenced by policies of this nature. If we look closely at all the documents in the case, including the EIS's for Indian Point Two and Indian Point Three, it appears that the NRC was following, at least

106. The position in the text is an application of Calabresi's "cheapest cost avoider" principle. See G. Calabresi, The Costs of Accidents: A Legal and Economic Analysis 135-73 (1970) [hereinafter cited as Calabresi]. This principle has been applied to environmental information costs. See D. Dewees, C. Everson & W. Sims, Economic Analysis of Environmental Policies 110-20 (1975) [hereinafter cited as Economic Analysis of Environmental Policies].
108. See id. at 152-60.
109. See Economic Analysis of Environmental Policies, supra note 106, at 119.
110. See Calabresi, supra note 106, at 143-44.
implicitly, the following procedures, and using the following weighting rules:

5. If the quantified benefits are greater than costs of protection only on the high estimate, or are lower on both (i.e., if the decision is information-sensitive), follow the procedures set forth below:
   (a) Determine how large the unquantified benefits would have to be to make total environmental damage greater than the costs of protection (i.e., calculate \( C_p - QB \)).
   (b) Identify all unquantified benefits (UQB's) and see what likelihood there is that they could exceed the difference between \( C_p \) and QB, using the following criteria:
      (i) place a low value on protection measures that can be discontinued if data show they are unwarranted;
      (ii) place a high value on any impact on the environment that will lead to an irreversible change in natural conditions;
      (iii) where there is any evidence to support the high damage estimate, use this figure (or magnitude) unless the preponderance of contrary evidence proves it wrong.

6. Compare, using orders of magnitude at least, the potential loss on the high estimate with the cost of securing the protection if the low estimate is correct. If the ratio is high, require the protective measure.

If this is what the NRC was in fact doing, its decision makes a great deal of sense. For **Indian Point Two**, steps 1 through 4 were carried out and this led to the decision that the cooling towers would be justified if UQB were $14.6 million on the low damage estimate and $10.4 million on the high. It was clear that there were at least three reasons for UQB's: (1) an underestimation of QB, since there was reason to believe that the figures used to estimate QB were low; (2) the value of harm caused to species other than bass; and (3) what could be called the "non-consumptive value" of fish. Moreover, if the high estimate were correct, there was a possibility that the striped bass population would decline permanently, and that other permanent ecological damage would be done. Since Con Edision could not disprove the possibility that damage would occur at the high estimate level, it seemed reasonable to assume that UQB could exceed $10.4 million a year, and thus that the cooling towers were an "economic" alternative if the high estimate were correct.

But this would not, under the rule of reason, have resolved the issue

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111. Since these steps follow from the initial four procedures which established that the decision was sensitive to information variations, the numbering continues the sequence begun above. See text accompanying notes 93-94 supra.

112. See 6 A.E.C. at 770 (discussing not only the commercial but the sport and aesthetic value of the fisheries). The opinion suggests that fish have a value over and above their economic value for consumption. This value could include the benefits to the population at
since it was not certain that the high estimate was correct. Thus it was also necessary to see what would be the social cost of requiring the towers if the low estimate were proven to be right. It was clear that there were some UQB’s, even on the low estimate, since estimates of QB were low for bass and since other species were not included in these estimates. However, the magnitude of UQB would be lower if the low damage estimate were right, since on that assumption the danger of irreversible damage—which has a high weight—was much less. Thus if the low estimate proved to be right, the cost of having chosen the cooling towers would be something less than $14.8 million per year.

Let us assume that if the low estimate of damage is correct, the towers will cost $10 million per year more than the environmental benefits they will yield. This calculation gives us the highest possible opportunity cost of building the towers. The issue becomes whether it is worth running the risk that this loss from possible overprotection will occur, in order to be certain that society will not have to pay the cost involved if no protection measures are taken and if the high estimate proves correct. It permits the decisionmaker to determine whether the possible cost of overprotection exceeds the possible benefits of requiring protection against harms whose ultimate magnitude cannot be quantified.

The NRC decided that in this case protection was worth this possible risk. The decision was made easier because the NRC’s decision itself was correctable. That is, until construction actually starts, Con Edison is free to bring in new data to show that the high estimates are incorrect. The decision places on the utility the burden of proving that the cooling towers are not “economic” as that term is used in this analysis; the decision requires that the towers be built unless that burden can be met in the near future.

The decision was probably made easier because the costs of the “insurance” factor can be spread among the power consumers. To the extent that all costs go into the rate-base of the utility, and eventually they all should be included in the rate-base, they will be passed on to all of Con Edison’s customers. Given the size and heterogeneity of that group, it may have seemed to the NRC that the costs of this “insurance” would not fall on any one social group or class. Thus equity as well as efficiency considerations may have influenced the final calculus. Another cost of having the towers—aesthetic degradation—will fall on those who live near the plant, but the Commission obviously thought these costs to be relatively small, and hoped they could be minimized by imaginative design.

The foregoing analysis indicates that Indian Point Two does not yield a single, simple rule of decision for allocating the burden of uncertainty. The reconstructed decisional process does, however, suggest

large of knowing that a natural species continues to exist, plus any potential economic value the fish might have under changed conditions in the future.
a procedure for making such decisions. It indicates how unquantified benefits can be compared with quantified costs, how the estimate of uncertainty can be integrated into the calculus of costs and benefits, and what factors, such as irreversibility and correctability, should be used in selecting appropriate weights for the value of possible harms and the costs of proposed protective measures.

Read in this way, Indian Point Two adds a great deal to our understanding of NEPA’s mandate. Seen as a case that requires both the procedures specified and the weighting rules indicated, and which places the burden of proof on the applicant, the case can be read as a detailed explanation of Calvert Cliffs’ call for “finely tuned and ‘systematic’ balancing.”113 And as a result, the case also stands as an interpretation of the substantive impact of NEPA on agency powers.

VI. THE LIMITS OF INDIAN POINT TWO: FROM CASE ANALYSIS TO NEPA GUIDELINES

The legal-economic analytic framework developed in this Note has made it possible more fully to understand the nature of the NRC’s decision in Indian Point Two, and to identify the general principles and specific weighting rules that seem to underlie the agency’s ruling. It is hoped that this analysis will permit future decisionmakers to understand the relevance of this opinion in other controversies. It is, however, important to recognize limits of the analytic framework and the specific holding. Because the analysis is only partial, and the holding limited to a very specific set of facts, this Note has only begun the task of fully understanding the nature of NEPA’s mandate in areas of uncertainty and unquantifiability.

The particular facts of Indian Point Two make it, in some senses, an “easy” case. Three features combined to create a relatively determinate solution to the problem facing the agency. First, there was substantial evidence that the construction of the plant, especially in light of other power plant construction on the river, could have irreversible effects on the Hudson and Atlantic fisheries. Secondly, the agency was able to devise a license condition that allowed time for the applicant to secure more information before the costly commitment to cooling towers had to be made. Thus the decision to require towers was, if erroneous under the cost-justified rule, correctible within a limited time at relatively low cost. Finally, the fact that the costs of the towers could be spread widely to electricity users through the rate-base may have made the distributional implications of allocating the burden of uncertainty to the utility less troublesome than they might be in other situations. On these facts, it is easy to see why the agency was not only able to derive the principle that NEPA requires cost-justified protective measures, but also to determine

that at the present time the cooling towers were "cost-justified" in the sense outlined above. But it would be harder to reach that conclusion in other cases in which harm is uncertain and/or the benefits unquantifiable, and in which there is less chance of irreversible harm, no easily correctible protection measure, and/or more severe distributional implications of allocating the burden of uncertainty to the applicant.

The analytic scheme developed here makes it possible to see why such changed conditions could lead to different results. But it does not provide detailed guidance to decisionmakers who confront such situations. It seems clear, however, that such guidance is needed. Problems of uncertainty and unquantifiability are common in environmental controversies. Yet neither the text of NEPA, CEQ or agency guidelines, nor case law provides any detailed guidance to agencies who must resolve these complex issues. This Note has suggested that legal-economic analysis can be helpful in developing such guidelines. But further work is necessary before general policies applicable to more difficult problems can be suggested.

This work will require two types of research. First, substantial effort will be needed to develop the legal-economic framework outlined here. It will be necessary to employ more sophisticated techniques. There is a relatively well-developed literature in the fields of decision analysis and operations research which deals in general with the problems of information cost and uncertainty. To date, this literature has not been directly applied to problems of environmental law. It is hoped that this Note has suggested the potential utility of such further research and the utility of these techniques in environmental decisionmaking under NEPA.

Secondly, it will be necessary to apply the elementary techniques used here, and more sophisticated tools that may be developed, to the analysis of other decisions by the NRC and cases of a similar import decided by other agencies. As this Note indicates, a substantive set of NEPA principles may be emerging out of the resolution of issues raised in cases like Indian Point Two. But these principles, if they exist, are not easy to discover. Even where agencies have acted on such principles, as NRC did in the case reviewed, they are not easy to discern merely from a reading of the reported opinions. Rather, it is necessary to examine the full record in the cases, including EIS's and cost-benefit analyses, to determine the nature of the principles and weighting rules that are actually being applied by agencies on a case-by-case basis. As difficult as this effort will be, it seems likely that it could have a high payoff for all those who seek more explicit guidance to decisionmaking in situations of environmental uncertainty.

A review of the opinions by the NRC subsequent to Indian Point

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114. For an introduction to this field, see H. RAIFFA, DECISION ANALYSIS: INTRODUCTORY LECTURES ON CHOICES UNDER UNCERTAINTY (1968).
Two suggests that such more detailed inquiry would clarify the policies of that agency. Subsequent licensing decisions have confirmed the holding in Indian Point Two that NEPA requires the agency to condition licenses on installation of cost-justified environmental protection measures. But opinions in those cases do not yield any substantial guidance on the question of how the agency is determining when a measure is cost-justified under conditions of uncertainty. Hopefully, further analysis of the type employed in this Note could provide such information.

VII. SUMMARY AND CONCLUSION

A major federal agency has construed NEPA as imposing substantive duties on it in licensing cases. These duties include requiring cost-justified environmental protection measures. Detailed legal-economic analysis is needed fully to understand the nature of this duty and develop guidelines for its exercise in conditions where application of the cost-justified principle are sensitive to uncertainties in data, including unquantifiable harms and benefits. Agencies making such decisions should be encouraged to clarify the nature of the principles being employed, and to support the research necessary fully to understand this emerging environmental policy law. The Council on Environmental Quality should consider developing formal guidelines to govern decisionmaking under conditions of uncertainty. And reviewing courts can assist in the process by encouraging agencies to make more specific statements of the principles used in cases like Indian Point Two, and by reviewing such principles in light of the congressional mandate for greater attention to the environmental impact of federal actions. Such actions by agencies and courts could contribute greatly to realizing the environmental goals the Congress set in 1969.