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Federal - State Cooperation in Nuclear Power Plant Licensing

M. B. Spangler

Office of
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ABSTRACT

The Calvert Cliffs decision of the U.S. Circuit Court (July 23, 1971) established a requirement for an expanded Environmental Impact Statement (EIS) involving an independent evaluation and balancing of environmental factors against benefits by the U.S. Atomic Energy Commission and its successor agency, the Nuclear Regulatory Commission (NRC). Since then, the AEC/NRC has prepared over a hundred EISs representing extensive review experience in dealing with highly varied environmental issues of a region-specific and site-specific nature as well as hearing issues of generic importance. A growing number of States have increased their involvement in environmental review and decisionmaking affecting the licensing of nuclear power plants. The diversity of siting and permitting laws as well as administrative policies and procedures by various States are potential sources of inefficiency in Federal-State cooperation. There are also problems of wasteful duplication and potentialities for delay in the licensing of nuclear power plants unless significant improvements are made in Federal-State cooperation. This paper, originally presented at the Third Annual Meeting of the National Association of Environmental Professionals in February 1978, is updated and presented in three parts. Part I, A Review of Roles and Environmental Issues, discusses: (i) environmental issues in licensing and the related roles of the NRC, the utility applicant, as well as other State and Federal agencies; (ii) the basis of interest for increasing State involvement in licensing activities; and (iii) the basis of interest in a continued Federal role. Part II, Diversity of State Practices in Nuclear Power Plant Licensing, provides a review of contrasting State roles and practices in the licensing process from selected cases, giving special attention to key environmental issues such as need for facility and site selection. Part III, Federal Initiatives to Improve Federal-State Cooperation in Nuclear Power Plant Licensing, describes a number of initiatives by the NRC to improve licensing cooperation including special programs to involve State officials in NRC workshops, formal agreements with States regarding licensing procedures, contractual and inhouse research studies on safety and environmental review methodologies of possible interest to States, improved coordination with other Federal agencies, and generic rulemaking and other efforts to increase licensing efficiency.

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PREFACE

Beginning in the Fall of 1979, the three major divisions of subject matter in this report are being published by the Pergamon Press as a series of three-part articles in The Environmental Professional, the journal of the National Association of Environmental Professionals. It is being republished here in a single volume in order to reach a more diverse audience, including various State and Federal agencies as well as other institutions and the involved public who have an interest in the nuclear power industry and the achievement of progress in dealing more effectively with associated environmental and safety issues including the possibility of legislative enactments or policy changes.

It is anticipated that this report may be of special interest to State officials who may be contemplating a changed or expanded role in electric power plant licensing and, particularly, whenever nuclear plants are being considered as a fuel option. In this regard, the recent bill (H.R. 6390) introduced by Congressman Udall to amend the Atomic Energy Act of 1954 has several sections which provide for a major State role in certain key aspects of nuclear power plant licensing: namely, site suitability certification (Sec. 112 a) and determination of need for power (Sec. 302b). The State would hold this responsibility unless the Governor of such State submits to the Nuclear Regulatory Commission a written statement requesting the Commission to make such determinations.

Thus, State and Federal legislators and administrators as well as various public and private parties whose interests may be affected by changing State roles in nuclear licensing may benefit from the descriptive materials in this study. Information on the diversity of State experience and the types of NRC initiatives and the availability of various kinds of procedural or substantive impact studies could provide useful information regarding State decisions on expanded roles as well as desirable avenues for improved Federal-State cooperation in nuclear power plant licensing with, or without, changing State roles.

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In drafting Part 2 on, Diversity of State Practices in Nuclear Power Plant Licensing, the author received much valuable information and review comments from the following individuals: Paul Massicot, Power Plant Siting Program, State of Maryland Department of Natural Resources; John Smolinsky, Office of Environmental Planning, State of New York Department of Public Service; Stewart Boschwitz, Electric Generation Facilities Siting, State of New York Department of Public Service; Robert Whitaker, Office of Research, State of New York Department of Public Service; Sam Tilaro, Power Division, State of New York Department of Public Service; E. Ross Deter, Energy Assessment Division, State of California Energy Resources Conservation and Development Commission; and Maurice Van Nostrand, Iowa State Commerce Commission.

Finally, but not least, I am deeply appreciative of the review counsel I received from Malcolm Ernst, Assistant Director for Environmental Technology in the NRC Division of Site Safety and Environmental Analysis as well as the editing services of Eileen Telford and Elizabeth Keeney.

FEDERAL-STATE COOPERATION IN NUCLEAR POWER PLANT LICENSING

PART I

A REVIEW OF ROLES AND ENVIRONMENTAL ISSUES

1. INTRODUCTION

The Calvert Cliffs decision of the U.S. Circuit Court (July 23, 1971) established a requirement for an expanded Environmental Impact Statement (EIS) involving an independent evaluation and balancing of environmental factors against benefits by the U.S. Atomic Energy Commission and its successor agency, the Nuclear Regulatory Commission (NRC). Since then, the AEC/NRC has prepared over 140 EIS's representing extensive review experience in dealing with highly varied environmental issues of a region-specific and site-specific nature as well as a number of hearing issues of generic importance.

In recent years, a growing number of States are increasing their involvement in environmental review and decisionmaking affecting the licensing of nuclear power plants. If problems breed opportunities and opportunities breed problems, it is clear that the duplication of review efforts associated with these developments provide a host of interesting and urgent challenges for improved Federal-State cooperation in developing a more effective review process for the licensing of nuclear power plants. The following is a preliminary list of problems and opportunities which require programmatic development and action (not necessarily stated in the order of their importance).

(1) How can wasteful duplication of information gathering and impact analysis and forecasting be reduced through improved Federal-State coordination?

(2) What solutions are best for the inefficiencies present in the dual and usually sequential hearings by State and Federal agencies in the licensing of nuclear plants?

(3) In a broader sense, how can costly delays in the licensing process be eliminated and potentially important societal benefits be achieved from an overall shortening of the time required to license and construct nuclear power plants (or, indeed, any major power plants)?

(4) How can public participation in the licensing process be made more effective and how can the number of hearing issues of limited consequence to the public interest be reduced?

(5) How can the relative strengths of Federal and State authorities and developing expertise be molded synergistically and productively into

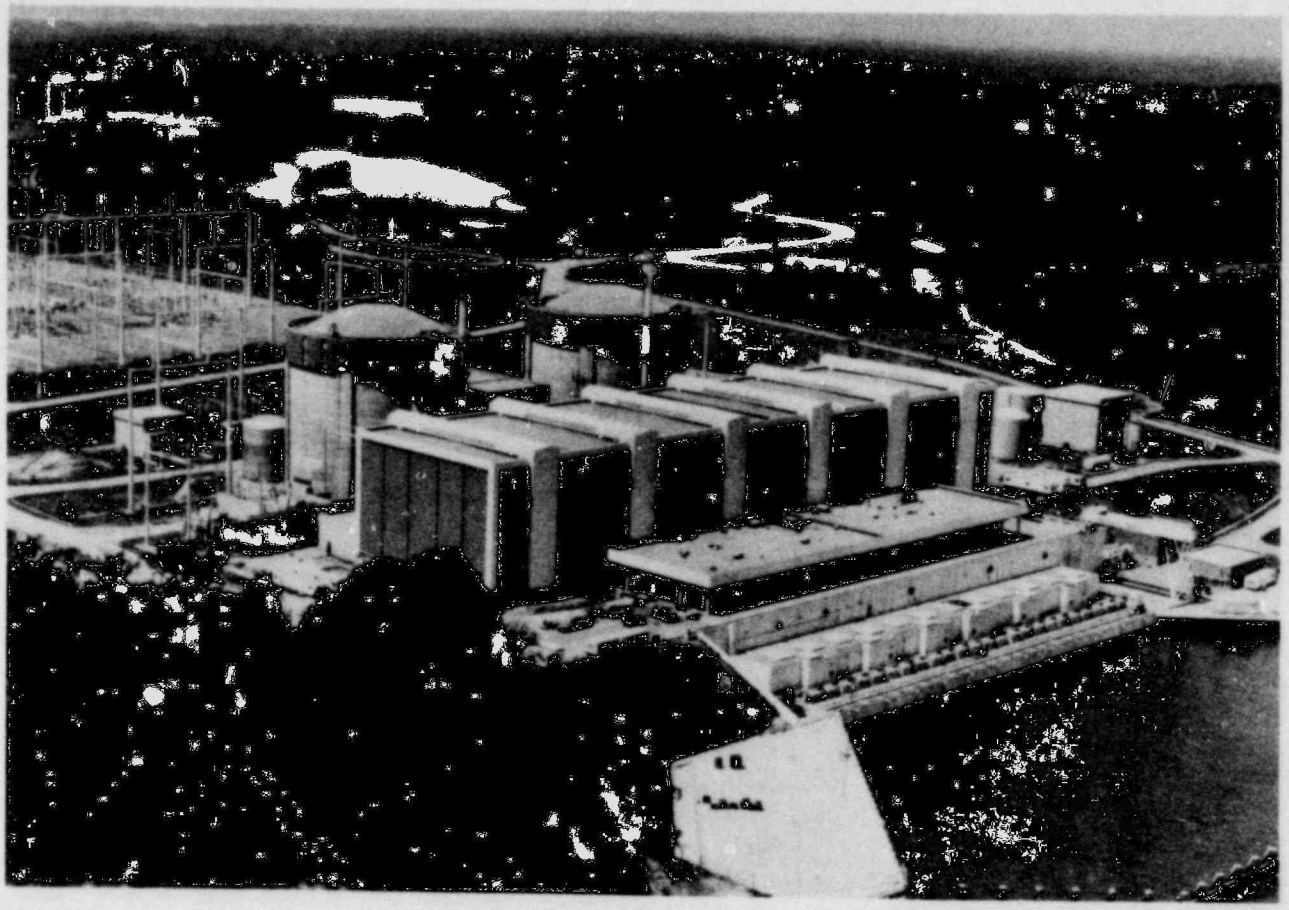

FIGURE 1. The Calvert Cliffs Nuclear Power Plant, owned by the Baltimore Gas & Electric Co., is now operating on the Western Shore of the Chesapeake Bay. Each of the two pressurized water reactor units has a net capacity of 854 megawatts of electrical output.

cooperative licensing programs, particularly during a period of transition and accommodation in Federal and State licensing roles?

(6) How can equity be responsibly improved in licensing decisions affecting conflicting public interests at the local, State, regional, national and international level, including equity between the interests and needs of present and future generations?

There are, of course, no easy answers to the complex and interrelated challenges posed by these questions. The present paper provides a preliminary sketch of the specific nature of the opportunities and problems of improved Federal-State cooperation in nuclear power plant licensing programs, what goals and values of society are at stake in improving cooperation, and the interrelated licensing roles of the utility applicant, the NRC, as well as other State and Federal agencies.

2. THE LICENSING ROLE OF THE NRC AS RELATED TO ACTIVITIES OF UTILITIES, STATES, AND OTHER FEDERAL AGENCIES

Before examining specific licensing issues which pose important challenges for improved Federal-State cooperation, it will be helpful to examine

briefly the present role of the Nuclear Regulatory Commission as it relates to the various activities of utilities and other governmental agencies involved directly or indirectly in the licensing process. Figures 2-6 provide simplified flow diagrams of these activities (Ref. 1). Because of the large number of agencies and activities involved as well as variabilities in activity participation (both as to timing and the occasional nature of involvement in specific activities), lines were not shown in these diagrams to interrelate the activities of other agencies with the licensing role of the NRC. Yet it is quite clear that a shifting of Federal-State roles in the review and licensing of nuclear power plants must accommodate the complexity of these interrelationships or a loss of effectiveness will likely occur. Some streamlining and consolidation of agency responsibilities could, of course, desirably reduce these complexities and improve licensing effectiveness, possibly with the aid of legislation at the Federal and State levels. Nevertheless, concentration of responsibility may be less than successful unless it is accompanied by a transfer or buildup of expertise, especially focusing on the information and analytical functions now performed by the various agencies.

As the AEC/NRC has gained experience in reviewing, stimulating and coordinating the various activities shown in these diagrams, it has made important improvements in its management of the licensing process. However, in view of the complex and dynamic nature of licensing issues as discussed below, additional steps are being taken by the NRC to further improve the effectiveness of its role in the licensing process (Ref. 2). These activities are dealt with in Part III.

3. ISSUES INVOLVING THE LICENSING PROCESS

There are important issues involving the licensing process as apart from the site-specific or region-specific substantive issues as implicated in construction and operating impacts. Process issues pertain to a number of ways by which the licensing process could be made more effective: (1) reducing delays and making the time and other requirements of the licensing process more stable and predictable; (2) making more efficient the role of public participation in the licensing process; and (3) improving the data base and methodology of analyzing and forecasting the environmental and societal impacts of the licensing decision and its alternatives so as to demonstrate more clearly the responsiveness of the decision to society's goals and values and to principles of equity and law (Ref. 3). Not surprisingly, there are vital linkages between these three categories of issues as related to the licensing process, making it difficult to address one without discussing the others.

Particularly since the Calvert Cliffs court decision there has been serious concern registered by the nuclear industry, the utilities, the Congress, the Administration and certain segments of the public over the growing length of time required to plan, license and construct a nuclear power plant. President Carter, in his April 1977 energy address to the Nation, drew attention to this problem and set as a national goal the reduction of this overall

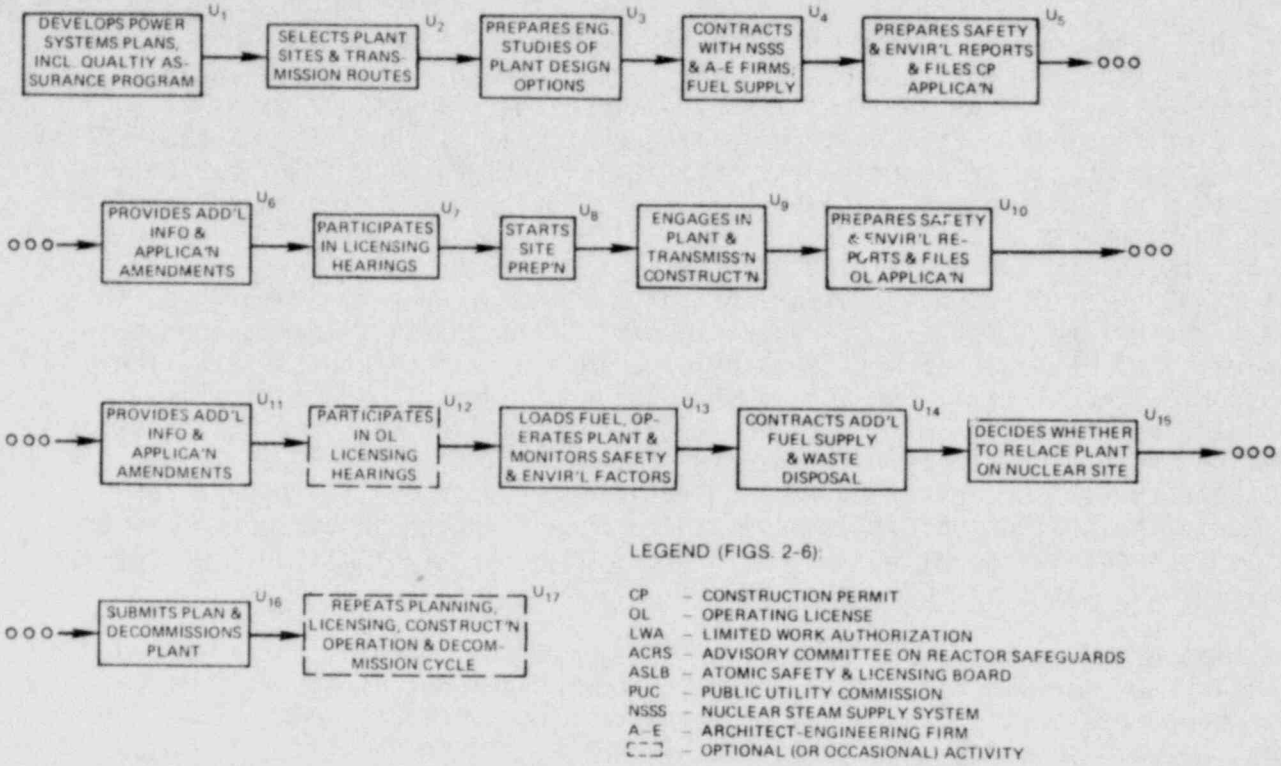

FIGURE 2. Utility Activities Related to Nuclear Power Plant Licensing.

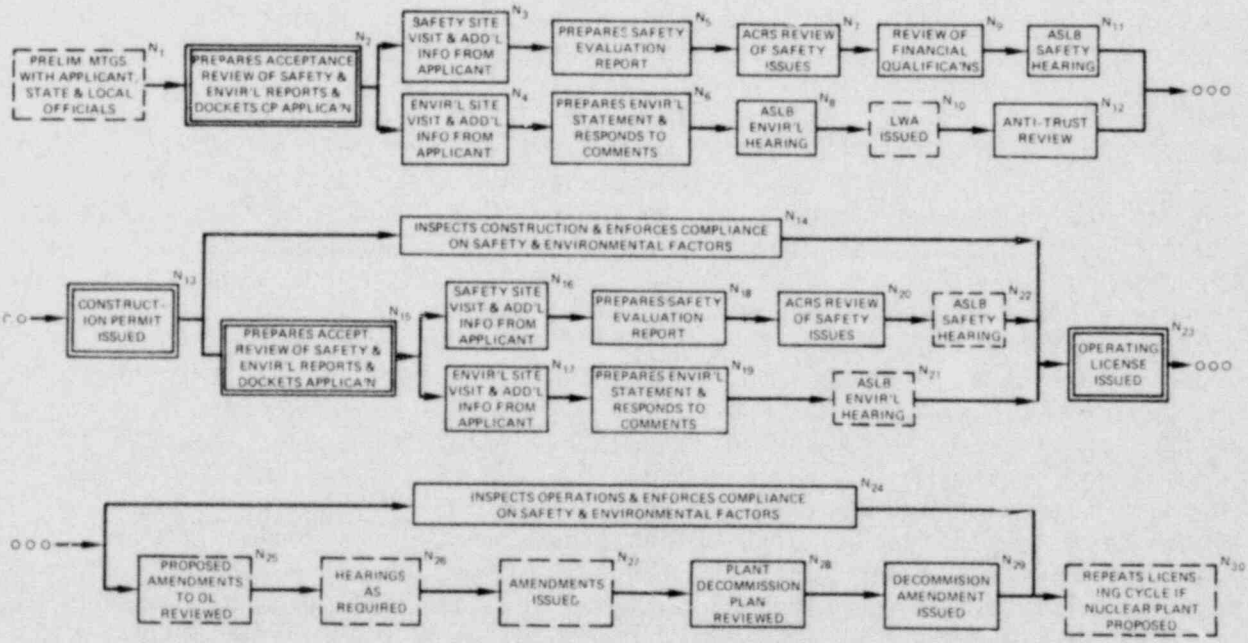

FIGURE 3. NRC Activities Related to Nuclear Power Plant Licensing.

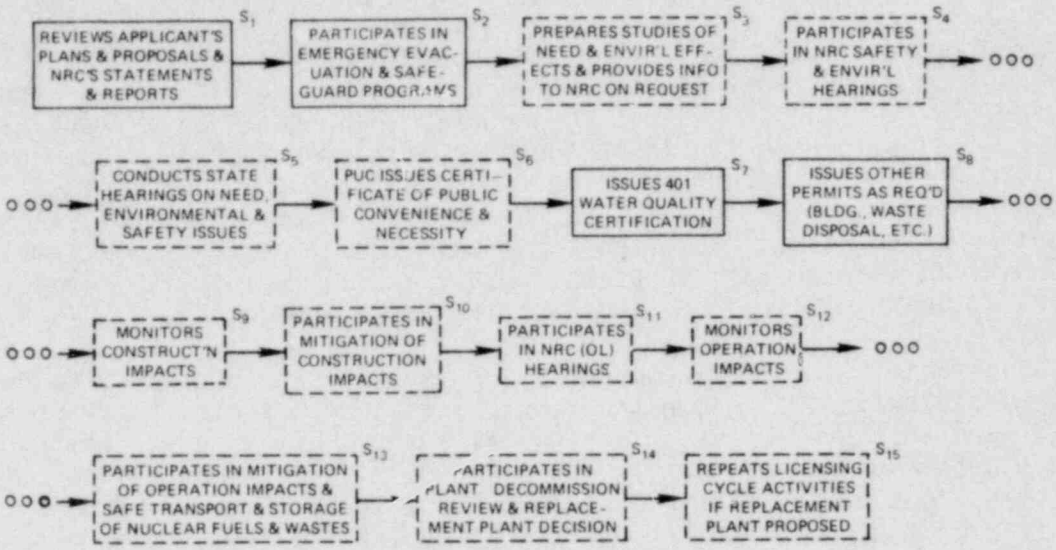

FIGURE 4. State Activities Related to Nuclear Power Plant Licensing.

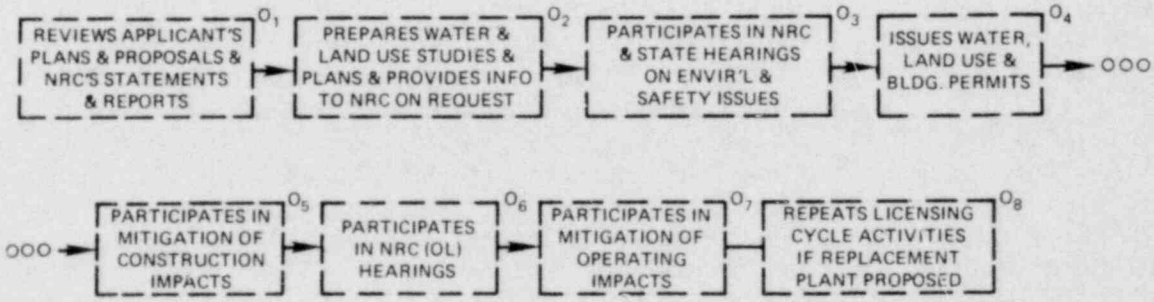

FIGURE 5. Activities of Other Local and Regional Agencies Related to Nuclear Power Plant Licensing.

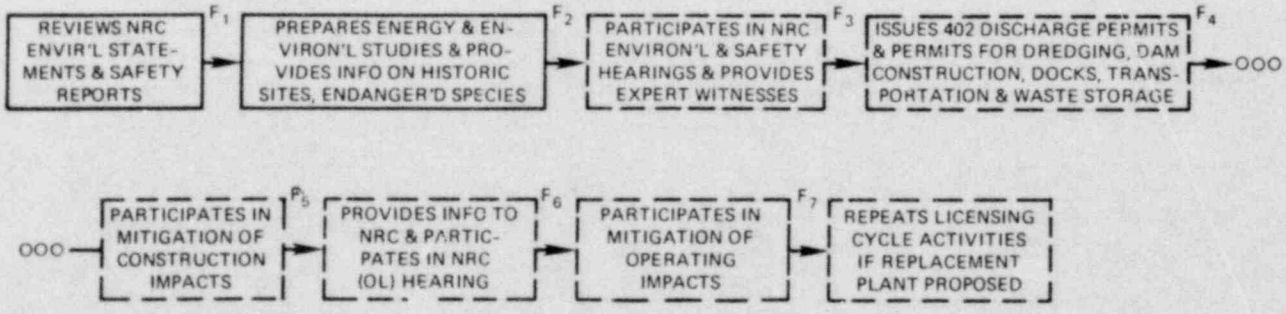

FIGURE 6. Activities of Other Federal Agencies Related to Nuclear Power Plant Licensing.

time requirement to six years from the present ten years. In Figure 7 (adapted from a GAO study of the nuclear licensing process) it is seen that the NRC Construction Permit review stage represents an average of about 2.5 years, or one-fourth of the overall time presently required to plan, license and construct a nuclear power plant (Ref. 4). It is to be noted that NRC Operating License reviews, which cover several years, are not a pacing item. Thus, the focal point for longstanding attempts by the NRC to shorten the licensing process and to improve its predictability is principally in the Construction Permit phase.

It will be helpful to examine briefly the penalties to society from delays in the planning/licensing/construction process and especially the unpredictability and instability resulting from licensing activities. The reduction of such penalties is, of course, the principal goal of measures to improve the licensing process. The NRC staff has estimated the cost of delay for a nuclear unit proposed to be operational by the mid-1980s to be around $8 million per month normalized for a unit of 1000 MWe capacity (Ref. 5). Such a unit would have a total capital cost estimated for this time period at around $0.8 billion to $1.2 billion. This cost-of-delay estimate was based on a projected $4.4 million per month incremental cost of construction (higher interest payments and escalated costs of materials and labor) and $3.8 million per month for makeup energy costs (excluding capacity charges) assuming coal as the replacement fuel. If oil were used as the replacement fuel, then the makeup energy costs could be over $4 million per month greater, yielding a total penalty of delay for a 1000 MWe unit of about $12 million per month. If reserve margins are to be maintained at planned levels, then capacity charges for the purchase of the makeup energy (assuming it is available) would add several million dollars per month to the above estimates. For example, TVA estimates (which include capacity charges) are $19 million per reactor month for an assumed three-month delay in the Hartsville nuclear plants, or $15.4 million per month when normalized for plants of 1000 MWe capacity.*

The societal consequences of these delay cost estimates would be experienced in higher electricity rates to the consumer and possibly a loss in system reliability with commensurate dislocations and penalties to the quality of life and productive efficiencies with an increased probability of brownouts and emergency outages. Other adverse societal impacts of delay might include: (1) increased air pollution from the use of fossil fuels for makeup energy; (2) delay of tax receipts and employment opportunities by the affected communities (often felt to be of greater benefit than adverse socioeconomic and environmental impacts that are also delayed); and (3) an adverse impact on national security and balance-of-payments position to the extent imported oil is used as the replacement energy.

*J. E. Gillaland, Assistant Manager of Power, Tennessee Valley Authority, personal communication to Secretary of the Nuclear Regulatory Commission, August 31, 1976.

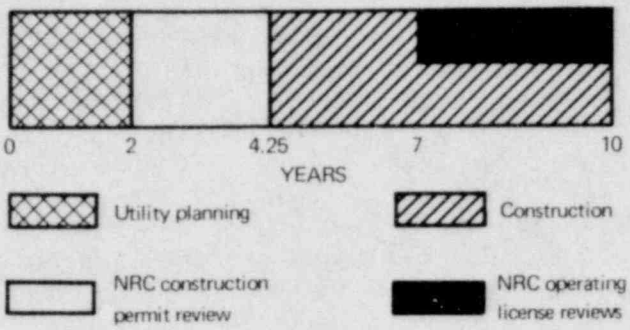

FIGURE 7. GAO Estimates of Average Time Requirements for the Planning, Licensing and Construction of Nuclear Power Plants (GAO, 1977).

Regarding a comparative analysis for nuclear and coal options of the health and safety aspects for the entire fuel cycle (mining, processing, transportation, electric generation, and waste disposal), Darrel Nash provides the following summarization (Ref. 5, p. 9):

> A number of studies have been done to estimate health impacts of coal and nuclear fuel use in steam-electric power plants. The estimates vary widely and in many cases the cause and effect relationships are only dimly understood. A report by Comar and Sagan (Ref. 6) reviews and summarizes 40 studies on this subject. One overall indicator of health impacts is the number of premature deaths. For a 1000 MWe power plant, estimated total occupational and public premature deaths per year for the entire fuel cycle range from 2 to 116 for coal and from 0.11 to 1.0 for nuclear.

A more recent study by Gotchy (Ref. 7) provides a range of estimates for excess mortality in the entire fuel cycle (including accident and disease rates for occupational and general public exposures) of about 1.0 for a nuclear reactor year (1000 MWe capacity) versus 15 to 120 for a coal-fired plant of the same capacity. One should not conclude from these figures that coal is not acceptably safe as a fuel choice in meeting our national energy requirements, but only that in using existing data on health impacts the nuclear option would appear to have a significant advantage over coal in this area of social concern.

A study by Herbert Inhaber (Ref. 8) provides safety comparisons for conventional energy sources such as coal, oil, nuclear, natural gas, wind power, methanol, solar (3 types), and ocean thermal. When one considers the safety aspects of the entire cycle (mining, transportation, electricity generation, and waste storage) as well as deaths associated with construction and non-fuel materials used in plant construction and operation, then the data assembled and analyzed by Inhaber suggest that electricity generated from nuclear fuel is substantially safer than solar energy, with natural gas yielding the best outlook for safety performance. Indeed, Wildavsky (Ref. 9) makes an interesting case that the elusive goal of zero risk for certain technological options tends to push society into choosing technological alternatives or modes of living that may be the highest risk of all.

The view is sometimes expressed that, insofar as the length of the planning/licensing/construction cycle is concerned, improvement in the predictability and stability of the licensing process are more important than reducing the length of the licensing process. One major aspect of societal penalty from the loss of predictability of the licensing process, namely delays, has already been discussed. Still another is the stress on utility management (as well as the licensing staff) due to the unpredictable need throughout the licensing process for additional information and analyses to better resolve the impact issues which emerge and that are subject to the requirements of defensibility in an adversarial hearing procedure.

Data presented by the aforementioned GAO study (Ref. 4) show that the average licensing review time (including hearings) for 24 contested applications accepted during 1971-1975 was 29 months, or 5 months longer than the average review time for 17 uncontested applications during the same period. Although delay is implicit in these figures, the real problem is not one of contested hearings per se since the very purpose of holding public hearings in accordance with NEPA is to provide opportunity for parties who feel their personal or property rights are threatened by the proposed action to be able to challenge under regulatory and legal procedures the adequacy of analysis and the correctness of the decisions made under a NEPA review which balances costs and benefits as prescribed in Section 102(2)(C) of the Act. Rather, the basic problem is one of finding ways to improve the effectiveness of the licensing review process so that there is less basis for contentions of faulty analysis leading to fewer issues being raised at hearings, plus an improved defensibility of the analyses which would shorten the length of hearing time required to treat whatever contentions are raised. Indeed, an indepth study by Gunther Schramm of the University of Michigan School of Natural Resources, sponsored by the National Science Foundation, explores beneficial as well as costly effects on society of time extensions in environmental decision processes (Ref. 10). Still another study (Ref. 11) analyzes the societal interests and economic costs of the lengthening period for nuclear power plant licensing and construction in the United States.

The role of public participation in the licensing process has been provided for as an important means of protecting the personal and property rights of those who may perceive themselves as losers in the proposed developmental action. Suggested sources of inefficiency in the exercise of the public rights of intervention in the licensing process include:

- Lack of public participation in the power systems planning and si selection process as well as the licensing review phase sufficiently early to hope to have a more significant impact on siting and energy systems development choices.

- Information deficiencies and lack of adequate analysis and forecasts of impacts in the safety and environmental reports supplied by the applicant and the NRC.

- Lack of financial resources and access to expertise by the public to make an effective intervention in defense of their personal and property rights.

- Inappropriateness of the adversarial nature of public licensing hearings which tends to reflect the polarization of views on the part of all parties rather than a forum better designed to seek the "truth" about the often conflicting nature of public interests and to promote greater openness and candor.

- Lack of public confidence in the regulatory or other governmental agencies involved in the licensing process which is heightened whenever these agencies draw different analyses and conclusions about the impacts and recommended actions.

Whatever the merits of these points of view--and most, if not all, would appear to have substantial merit--it is clear that the collective impacts of these defects in the role of public participation in the licensing process have contributed significantly to delays and loss of predictability and stability in the licensing process. In addition to the undesirable social implications inherent in these effects, which have already been discussed, is the resultant loss of good will and morale among the affected parties in place of feelings of mutual respect and trust which is the sine qua non of good government. Thus, measures designed to improve the effectiveness of the licensing process, including Federal-State cooperation, must accommodate the need to rectify shortcomings in the role of public participation in the nuclear licensing process as now exercised.

As noted above, the third category of issues related to the licensing process involve those of improving the data base and methodology of analyzing and forecasting the societal impacts of the licensing decision and a reasonable set of alternatives so as to demonstrate more clearly the responsiveness of the decision to society's goals and values and to principles of equity and law. This source of deficiency in the licensing process has already been noted in a discussion of issues surrounding the role of public participation.

However, given the inherent complexities of the analytical problems associated with a review of the societal impacts of proposed nuclear power plants and their alternatives, it should not seem surprising that there is a cascade of issues falling behind certain frontline issues. The informational issues surrounding the cost-benefit analysis of environmental impacts, or impact-value assessment in the case of safety impacts, have to do with rather subtle matters. For while it would appear generally true that all parties to the licensing process would like to have more information of improved accuracy or reliability upon which to base their analyses and conclusions, there are a number of stumbling points which thwart the attainment of an idealized set of information:

- Information has a cost of time, money, and level of resource commitment. Realistically, budgetary constraints and priorities have to be reckoned with in improving the amount and quality of information that can be made available.

- A number of societal impacts are not quantifiable, or at least not in commensurable units which permit the determination of a numerical benefit-cost ratio so as to compare more objectively the relative merits of alternatives (Ref. 12). The resulting decisions based on a balancing of costs and benefits, some of which are stated in subjective, qualitative terms, often leaves certain segments of the public with the feeling that the decisions have been arbitrarily made insofar as their perceived interests are concerned.

- The societal importance of certain impacts often requires a forecasting methodology to be employed covering a host of causal factors, some of which are external to the immediate licensing action and possibly not subject to much, if any, control of the utility applicant or the regulatory agency. An adversarial, legal type of hearing process works best when assessment of impacts are subject to demonstrable "proof." Thus, the presence of substantial speculative elements in forecasting methodologies serves as a reminder of the elusive goal of "knowing the unknowable" or "proving the unprovable". In the face of a range of uncertainty surrounding forecasts by whatever methodology is employed, there is an understandable tendency of parties to the hearing process to seize upon forecast values at the low or high range of uncertainty that are most favorable to their interests, as opposed to the more probable forecast values.

Process issues arising from this latter source are exacerbated by a widespread lack of expertise in forecasting methodologies most suited to the complexity of beneficial and adverse impacts associated with the proposed licensing action and its alternatives (Ref. 13). However, the overall social merit of enlarging the data base upon which to assess impacts or to prepare more reliable forecasts must itself be subject to a judgmental cost-benefit analysis. A number of court decisions pertaining to controversial issues of Environmental Impact Statements have recognized the desirability of limiting the forecasting of impacts to those which "are reasonably foreseeable," "avoid crystal ball inquiry," do not have the joint characteristics of being "remote and speculative," or are not compounded as "a possibility upon a possibility." The importance of this category of issues pertaining to the licensing process, although generic in character, is better understood in the context of substantive impact issues discussed below.

4. SUBSTANTIVE IMPACT ISSUES

The nuclear licensing process has been beset with numerous controversies arising over the substantive impact issues such as demonstration of need for additional baseload generating capacity, the relative dollar cost and other advantages of one fuel option over another, the relative merits of alternative sites, the comparative costs and benefits of plant design options such as different coolant water systems, the need for mitigative measures to reduce socioeconomic and environmental impacts or improve safety, and the cost and adequacy of short-term and long-term waste storage systems, safeguard measures, and plant decommissioning (Ref. 14).

The emergence and relative importance of these substantive issues is often strongly influenced by site-specific or region-specific characteristics, circumstances, and developmental outlook. The emergence and importance attached to substantive issues is often subject to the skills and creative capabilities of intervenors, their hierarchy of values, and the level of information or misinformation by which they perceive and explore certain issues. Since the human values affected by a nuclear plant may be in conflict with each other or have different levels of significance to different individuals, groups or organizations, a key role (although not the only role) of government in preparing Environmental Impact Statements and recommended actions is that of an arbiter of different kinds of public interests. These recommendations, in accordance with the requirements of NEPA, must be based on a balancing of costs and benefits while seeking the most socially responsible tradeoffs in the selection of siting and technological options which balances the costs and benefits for a wide variety of public and private interests, including segments of interest not represented at hearings by intervenors. By the nature of the problem, it cannot be assumed that the recommended tradeoffs and supporting analyses will not leave some parties with the feeling of being losers and it is primarily from this group that public intervention emerges.

Thus, an understanding of the value systems of potential intervenors and hence the ability to predict the controversial issues that will most likely emerge at public hearings is very basic to improving the effectiveness of the licensing process. Also, quite basic is an appreciation of the kinds and quality of information and beliefs held by potential or known intervenors. Much can be learned about the likely emergent issues at hearings and the quality of information and beliefs that fuels them by early meetings with key public officials (local, State and regional) and community leaders on the site visit in advance of the preparation of Environmental Impact Statements and Safety Evaluation Reports.

It is particularly important to discover as early as possibly whenever misinformation could be a major cause of lengthy and heated hearing issues on substantive matters. For example, from interviews on a site visit in connection with the proposed backfitting of cooling towers at the Indian Point nuclear plant (Unit 2) along the Hudson River south of Peekskill, New York, it was learned that a number of parties would oppose this action, in part at least, because of unsubstantiated and misinformed concerns or fears that the vaporous plumes and related salt drift from these towers would, in all probability: (1) deprive access of nearby residents to sunshine a high proportion of the time; (2) make it impractical to grow tomatoes and other garden vegetables; and (3) provide a serious health hazard for asthmatic patients. Assuming (incorrectly) these impacts would materialize from the construction and operation of cooling towers led to the derived concern over loss of property values resulting from these undesirable effects. Once identified, the validity of these potential issues was investigated and treated in the Environmental Impact Statement, largely defusing these concerns from becoming significant hearing issues (Ref. 15).

Likewise, interviews on a site visit with local citizens in the vicinity of the (then proposed) Seabrook nuclear plant on the seacoast of New Hampshire revealed that some attitudes of those opposing the plant were based on highly exaggerated views of potential adverse impacts on sportfishing based on erroneous beliefs that the seawater in the general vicinity of the condenser coolant water discharge system would be heated by 100°F to 1000°F above the ambient temperature of the seawater, thus killing substantial quantities of fish. No scientific computations of thermal discharge effects on ambient water temperatures nor empirical data of thermal effects from similar discharge systems already operating would, of course, support such extreme beliefs.

Regarding safety matters, the public's views are, if anything, even more subject to inadequate knowledge or misinformation than in environmental matters. Although recent voting on State referenda on the nuclear power option and a sizeable majority of public opinion polls reflect a roughly two-to-one margin of public acceptance of nuclear power (Ref. 16), considerable problems remain concerning the adequacy of public knowledge and beliefs on nuclear safety. In contrast with the informed estimates of the comparative health and safety advantages of nuclear over coal as fuels for generating electricity as cited above, a 1975 public opinion survey showed that 73% of the respondents ranked nuclear power as the "most dangerous" of six fuel options and only 2% ranked coal as the most dangerous fuel choice (Ibid., p. 234). However, Harris Poll (1975-1976) which addressed public attitudes about nuclear safety in an absolute sense (rather than in comparison with other fuels) showed that 60% of the respondents felt that nuclear power plants are safe and about 20% felt they are not safe; among nuclear plant neighbors (hopefully, better informed) about 75% believed in the safety of nuclear plants (Ibid., p. 146). Interestingly, and perhaps meaningful in terms of understanding the role of misinformation on public attitudes, a Harris Poll (1975) found that 39% of the respondents felt that a nuclear plant could be subject to a "massive nuclear explosion," while only 24% did not think the plant could explode (Ibid., p. 157). The latter, of course, is the correct view.

One group of environmental issues receiving frequent and extensive coverage in environmental hearings are those surrounding an examination of the need for added baseload generating capacity. Not in the past several decades have there been so many conflicting signals to energy planners as in recent years about what the future portends. Since the energy crisis began with the oil embargo of October 1973, there has been a succession of bewildering events: fuel shortages, double-digit inflation; a prolonged economic recession; conservation measures which dampen the growth of electrical energy demand; high interest rates along with unattractive profit margins of utilities, making it difficult to borrow funds for the expansion of electric generating capacity; opposition to nuclear energy on the grounds of safety and environmental impacts increasing the length of the licensing process and the costs of delays; cancellations and stretchouts of proposed nuclear and coal-fired generating facilities; sharp rises in the price of coal and nuclear fuels and difficulties in securing contracts for long-term fuel deliveries; and a turn to low reserve margins which increases the risk of brownouts and other undesirable impacts of unreliable electricity supply.

The traditional methodologies employed by utilities in forecasting electrical energy growth and generating capacity (or demand) requirements prior to the oil embargo (and even still) were highly varied, often oversimplistic, and generally poorly suited to the variety of perturbations introduced by the energy crisis (Ref. 13). Although significant changes in these forecasting methodologies have since been introduced, intervenors in the licensing process have had a heyday in exploiting structural weaknesses in forecasting methodologies. The most troublesome issues in defending the forecasting methodologies employed have focused on:

- Projected price elasticities and rate structure changes often proposed in a drastic form by intervenors with questionable desirability and practicality.

- A staggering list of voluntary and involuntary, nonprice conservation measures, many of which are of speculative realization with little or no empirical data to estimate reliably their implementation and the timing and degree of impact (Ref. 17).

- Less frequently, but still important, the question of adequacy of reserve margin and reliability criteria.

- The inherent difficulty of demonstrating in an ex ante sense that the forecasting methodologies employed are adequately reliable in their own right, or not inferior to those proposed by intervenors, which provide drastically reduced forecast levels.

Issues over forecasting are also found in a different set of substantive hearing interventions, namely, the economic comparison of nuclear and other fuel options for the baseload generation of electricity. Here, the forecasting of the future price and availability of alternative fuels is often a highly controversial matter. Factors of uncertainty include: (1) the accuracy and cost of recovery of proven reserve estimates of fuels such as coal, uranium, oil, gas, shale oil, geothermal, etc.; (2) future discoveries of additional resources; (3) technological developments and various market factors which would increase or decrease historic rates of resource utilization; and (4) social or political changes which would affect supply and demand factors of fuel options at the regional, national and international levels (Refs. 18 and 19). Other substantive issues relate to the economics of the total fuel cycle (Ref. 20) including mining, transportation, processing or enrichment, waste storage, safeguards, and plant decommissioning as well as comparative plant capacity factors or reliabilities in generating electricity and escalation and discount rates in estimating capital costs of construction. All of the above are highly technical and complex subjects far exceeding the immediate knowledge of an individual reviewer, who accordingly must traffic in procedures and methodologies of "borrowed expertise," raising certain vulnerabilities in the context of an adversarial type of public hearing as well as the imposing multidisciplinary skills required in the analytical assimilation of diverse sources of pertinent information.

Moreover, intervenors often raise issues over the adequacy of analysis of alternative nonconventional fuel sources whose technological and economic

performance are highly uncertain because of their experimental or developmental status or the resource is of limited regional availability or questionable reliability. Included are assorted solar technologies, wind power, geothermal (steam, hot water or hot rocks), tidal energies, ocean thermal energy conversion, and biomass sources including wood and other vegetative products as well as urban and industrial refuse.

Community level impacts of substantive importance provide a relatively spotty set of hearing issues that are rather sensitive to site-specific characteristics, regional patterns of land and water use, developmental or antigrowth interests, etc. In the past several years socioeconomic impacts have been growing in importance as hearing issues. Sometimes this emerges as at the Hartsville nuclear plant (Tennessee), Pebble Springs nuclear plant (Oregon), and the Marble Hill nuclear plant (Indiana) as concern for the stress on community services (schools, hospitals, highways, water and sewer facilities, etc.) or on economic infrastructure such as housing that result for a period of six to ten years of influx of construction workers involved with single or multiunit plants (Ref. 21). Thus, better forecasting methodology to predict more reliably the residential pattern and demographic characteristics of several thousand construction workers and their families is needed along with an identification of potential mitigative measures that are available to local and State governments to ease these stresses.

Another type of community-level concern that arose in certain licensing actions such as Davis Besse (Ohio) and Montague (Massachusetts) is that of an undesirable stimulation by plant construction of industrial and economic growth. A number of residents of lightly populated rural counties in which nuclear plants are generally located prefer to preserve the quite, relaxed character of their communities and possess anxieties that the nuclear plant will bring radical changes. A different kind of issue developed at the Seabrook nuclear plant (New Hampshire) and the Atlantic Generating Station (offshore of Atlantic City) where apprehensions emerged over future adverse impacts on tourism.

Other kinds of socioeconomic issues include: diversion of prime agricultural land (LaSalle and Clinton plants in Illinois and South Texas plant); aesthetic impacts on residential land use and recreation (Bailly plant in Indiana, Seabrook plant in New Hampshire, St. Lucie plant in Florida, San Onofre plant in California, and Indian Point plant in New York); water consumption impacts (Limerick in Pennsylvania, Perkins in North Carolina, Koshkonong in Wisconsin, and Sundesert in California); and stress on cultural and religious institutions due to families displaced from the plant site (LaSalle in Illinois). Quantification methods for assessing socioeconomic and other environmental impacts in nuclear power plant siting are addressed by Keeney and Nair (Ref. 22).

Ecological impact issues are not as frequent or serious as might be supposed. In part this is due to exercise of care in the selection of plant sites and transmission routes, the application of stringent water quality standards by the EPA or State regulations, greater use of closed-cycle cooling systems, and improvements in mitigative measures such as design and location of water intake and discharge structures.

Nevertheless, concerns for adverse impacts on terrestrial biota surfaced at Midland (Michigan), Marble Hill (Indiana), and Bailly (Indiana). Issues over potentially adverse impacts on aquatic biota were encountered at Indian Point (New York), Brunswick (North Carolina), Calvert Cliffs (Maryland), Hartsville (Tennessee), Turkey Point (Florida), Seabrook (New Hampshire), Arkansas One, and LaSalle (Illinois). The latter had an unusual twist in that issues arose over the merits of the sportfishing recreational benefits being created by the proposed nuclear plant and its large artificial cooling lake, since the major source of makeup water for the lake is the Illinois River into which Chicago discharges effluents from its sanitary waste water treatment system.

To the extent that socioeconomic and ecological impacts become local or regional issues, there is often a strong tendency on the part of intervenors to look for weaknesses in the methodology of comparing the beneficial and adverse impacts of alternative sites. The "put-it-in-Texas" syndrome, which raises equity problems of a spatial sort, serves to increase the burden of analysis including close attention to the local and regional benefits of the proposed plant and its siting alternatives as well as the external (non-dollar) costs to which intervenors direct their attention. In this regard, employment and regional income benefits become significant, but often the major benefit by far is the increase in State and local tax receipts. For example, many counties in which nuclear plants are proposed would stand to receive a twofold to twentyfold increase in their annual tax revenues unless they decide to receive part of this benefit in the form of a reduction in property tax rates (which is also a significant benefit). The combination of improved community services and social infrastructure made possible by increased tax revenues together with a reduction in the property tax rate is a powerful stimulus to an increase in property values changing, in due course, the socioeconomic character of the affected communities (Refs. 23 and 24).

The tax benefits, in effect, may generally be regarded as a transfer payment from the electricity consumers, who are distributed over a fairly wide region, to certain local communities (counties, townships or school districts) which more or less experience the brunt of the adverse external impacts of the plant. To this extent, tax payments serve as a (sometimes excessive) internalization of the externalities, but only for those communities or tax jurisdictions which receive these benefits. The problem of inequities of the distribution of these benefits over space and time may still lead to significant issues in the licensing process. For example, some communities receiving tax benefits do not receive them early enough to relieve the initial stresses on community services imposed by an influx of construction workers; and some neighboring cities or counties experience some of these stresses without receiving any tax benefits except those redistributed to them out of increased State tax revenues (or payments in lieu of taxes paid by government-owned utility investments). Measures to mitigate such spatial and temporal inequities of tax revenues are open to State and local governments, but few have yet moved to deal adequately with these problems. However, solutions to the problem of temporal (but not spatial) inequity of tax revenues have been worked out in the case of the Millstone nuclear plant in Connecticut (Ref. 23) and the Pebble Springs nuclear plant in Oregon (Ref. 25).

5. THE BASIS OF INTEREST FOR INCREASING STATE INVOLVEMENT

One of the reasons for increasing involvement by States in the nuclear plant licensing process is the growing number of States which have, or are planned to have, nuclear power plants plus the growing number of nuclear units that are projected to be in place in another ten years in many of these States. In Table 1 is shown the number and capacity of nuclear units by State that are already operating, under construction, or which have applications docketed by NRC for construction permit review and which will most likely become operational on or before 1990. It is interesting to note that 38 States plus possibly Puerto Rico are projected to have operating nuclear plants by 1990. Perhaps only one or two of the remaining 12 States will join the nuclear power group before the turn of the century, inasmuch as a number have limited population and projected electrical energy requirements conducive to economic, large-scale nuclear power plants, and others are reasonably close to major deposits of low-sulfur coal.

Included in this nonnuclear power group of 12 States are: Alaska, Hawaii, Idaho, Kentucky, Montana, Nevada, New Mexico, North Dakota, South Dakota, Utah, Wyoming and West Virginia. Thus, the subject of Federal-State authorities and cooperation in nuclear power plant licensing should principally be focused on the present or projected nuclear power States found in Table 1 and especially on those which will have the highest nuclear power ranking. By 1990, the ten States with the largest projected nuclear capacity by rank order are: Illinois, Tennessee, Pennsylvania, North Carolina, South Carolina, New York, Washington, Ohio, New Jersey and Texas. Other States may also assume considerable importance to the subject of discussion in this paper because of their relatively high expectations for a number of nuclear licensing actions in the next decade, especially their involvement in the generally more analytically difficult and controversial Construction Permit licensing actions. States falling in the latter group but not included in the top ten ranking by total nuclear capacity in 1990 include: California, Michigan, Alabama, Virginia, Mississippi, Wisconsin, Massachusetts, Maryland, Florida, Georgia, Arizona and Oregon.

Most likely, the second most important reason for growing State involvement in the licensing of nuclear power plants is the widespread belief that the highly important local and regional impact analysis of nuclear plant proposals and their alternatives, and the decisions related thereto, can be more effectively and responsibly made at the State rather than the Federal level. There is, of course, considerable merit to this view. Many of the benefits of good energy planning, or the penalties of bad energy planning, in which nuclear licensing might be implicated would be borne by the States themselves. Thus, the States would appear to have a large incentive to conduct licensing reviews and make decisions which would have the most favorable mix of costs and benefits given the developmental aspirations of the particular State and the relative advantages and disadvantages of energy and siting choices reflecting the characteristics of resource and site availability open to the State. Many would apparently feel it is of questionable political ethics for the Federal Government to exercise a dominant role in those aspects of energy development planning wherein the penalties for error in decision-making are not substantially shared by the decisionmakers themselves. The

TABLE 1

Present and Future Involvement by States in Nuclear Power Generation Through 1990[a]

State	Units in Operation		Units Under Construction		Projected Operating Units, 1990		Projected Rank in 1990	State Siting Law
	No.	Capacity (MWe)	No.	Capacity (MWe)	No.	Capacity (MWe)		
1. Ala.	4	4,024	3	3,255	7	7,279	13	
2. Ariz.	0	—	3	3,714	3	3,714	21	x
3. Ark.	1	850	1	912	2	1,762	30	x
4. Calif.	2	1,348	4	4,390	8	7,686	11	x
5. Colo.	1	330	0	—	1	330	39	
6. Conn.	3	2,065	1	1,156	4	3,221	23	x
7. Del.	0	—	0	—	1	1,200	33	
8. Fla.	4	3,013	1	810	5	3,823	19	x
9. Ga.	1	786	3	3,021	4	3,807	20	
10. Ill.	7	5,446	8	8,502	15	13,948	1	
11. Ind.	0	—	1	645	3	2,905	25	
12. Iowa	1	538	0	—	1	538	37	x
13. Kans.	0	—	1	1,150	1	1,150	34	x
14. La.	0	—	3	2,981	3	2,981	24	
15. Maine	1	790	0	—	1	790	35	
16. Md.	2	1,690	0	—	4	3,982	18	x
17. Mass.	2	830	0	—	5	4,310	17	x
18. Mich.	3	1,794	4	3,424	9	7,618	12	
19. Minn.	3	1,605	0	—	3	1,605	31	x
20. Miss.	0	—	2	2,500	4	5,070	15	
21. Mo.	0	—	2	2,240	2	2,240	29	
22. Nebr.	2	1,235	0	—	2	1,235	32	
23. N.H.	0	—	2	2,400	2	2,400	26	x
24. N.J.	2	1,740	4	4,319	8	8,359	9	x[b]
25. N.Y.	5	3,667	3	3,069	11	10,227	6	x
26. N.C.	2	1,642	2	2,360	11	11,442	4	
27. Ohio	1	906	3	3,220	8	8,458	8	x
28. Okla.	0	—	0	—	2	2,300	27	
29. Ore.	1	1,130	0	—	3	3,650	22	x
30. Pa.	4	3,801	6	5,988	12	12,109	3	
31. R.I.	0	—	0	—	2	2,300	28	
32. S.C.	4	3,373	6	7,030	10	10,403	5	x
33. Tenn.	0	—	8	9,582	11	12,398	2	
34. Tex.	0	—	4	4,800	7	7,786	10	
35. Va.	2	1,644	4	3,628	6	5,272	14	
36. Vt.	1	514	0	—	1	514	38	x
37. Wash.	0	—	2	2,318	7	8,574	7	x
38. Wisc.	4	1,579	1	1,150	7	4,529	16	x
39. Puerto Rico	0	—	0	—	1	583	36	
Total	63	46,340	82	88,564	197	192,498	—	19

Source: Facilities License Application Record, OMIPC:NLD:589, U.S. Nuclear Regulatory Commission, Sept. 30, 1977 plus supplemental information as of 1/13/78.

[a]Assumes nuclear plants for which applications are already docketed by the NRC will be in operation by 1990. Units announced or ordered but not docketed are excluded. Also excluded are two pioneer units presently shutdown (in New York and California) whose resumed operation is questionable.

[b]Siting law applies to coastal zone only.

latter point of view is certainly more appropriate in consideration of the socioeconomic and environmental impacts that are registered at the local or regional level and much less valid for licensing considerations involving matters of national security and public health and safety.

A third rationale for States assuming a greater role of responsibility in nuclear licensing actions is that there are often highly important interactive roles of State and local governments in a timely development of measures to mitigate adverse socioeconomic impacts, discussed in an earlier section, resulting from stresses imposed by the influx of nuclear plant construction workers on community services or localized problems such as housing, water supply, sewage treatment, schools, medical services, recreational facilities, highway traffic, tax inequities, land use, etc. Zoning and other preplanning activities by State and local governments play a highly useful role in reducing potentially adverse socioeconomic, community-level impacts of plant construction and operation (Ref. 23). Were the States themselves to play a more active and earlier role in analyzing the potentially adverse socioeconomic community-level impacts of nuclear plant proposals, they would most likely achieve an earlier awareness of these impacts and an appreciation of the importance of developing mitigative measures on a more timely and adequate basis. Other areas of early and more effective State participation in the planning of mitigative measures due to a higher level involvement in the nuclear licensing process relate to a number of safety measures. Included are such matters as the development of emergency evacuation plans involving participation of State and local agencies (Ref. 22) and the safe transportation and storage of nuclear fuels and wastes.

A fourth rationale for an expanded State role in nuclear power plant licensing activities is that statutory authorities are more favorable to the States engaging in more symmetrical or parallel licensing practices than the Federal government regarding all energy sources needed on a timely basis in generating electricity. Especially germane are both coal and nuclear fuels which are widely agreed by energy analysts to provide the major fuels for new baseload electric generation facilities to be built in the remainder of this century (Refs. 27-32). Certainly the statutory authority of the NRC is asymmetric in at least one key respect: although the NRC review in Construction Permit licensing examines the relative costs and benefits of nuclear and optional fuels (notably coal), it has no authority to examine the relative merits of the nuclear fuel option whenever coal-fired plants are proposed for construction by utilities (since generally no Federal license is required for coal-fired plants unless Federal lands are involved).

If independent review by government agencies of utilities' initial planning decisions regarding the addition of baseload generating capacity is desirable in regard to the full range of fuel choices which are actually proposed for construction, only States presently have such statutory authority. In Table 1 it is seen that 19 of the 38 projected nuclear power States already have State siting laws. Most of these apply equally to large-scale coal-fired and nuclear-fueled generating plants, thus providing for more symmetrical review of applications for siting and licensing of coal and nuclear plants. Moreover, many of these States make independent reviews of the timing of additions of major baseload capacities proposed by utilities, and some States also engage in the preparation of independent forecasts of growth in electrical energy demand.

Still a fifth rationale for increased State responsibility in the licensing of nuclear power plants is that States have certain advantages of detailed information at their disposal. This is especially valid regarding information essential to appraising the efficacy of alternative measures which State and local governments are most inclined to implement in mitigating certain socioeconomic impacts as noted above. Likewise, States have better command over information essential to improved forecasting of the timing and effectiveness of State or local government measures to induce conservation of electrical energy including any rate structure changes that may be imposed by State public utility commissions.

In sum, there are a substantial number of imposing reasons why States should exercise an expanded role in the licensing of nuclear and other major energy facilities to ensure an adequate and economical supply of energy for future developmental goals that are consistent with the protection of values inherent in the natural and human environments of concern to their State.

6. THE BASIS OF INTEREST IN A CONTINUED FEDERAL ROLE LEADING TO IMPROVED FEDERAL-STATE COOPERATION

If it is true that States should have a strengthened role in nuclear power plant licensing in particular and energy planning in general that affects their interests, it is also true that there is an ample basis of interests, as supported by law, for the Federal Government to exercise a continued role in such matters. Foremost is the observation that there are certain public interests that are chiefly national in scope requiring an important degree of Federal responsibility and leadership in protecting or enhancing. Included are the following:

- The development of domestic energy resources which will enhance our national security interests, including measures to safeguard against the diversion of nuclear materials to illicit purposes.

- Protection of public health and safety in activities identified by law.

- Avoiding and dealing with the adverse impacts of balance-of-payments deficits associated with excessive levels of energy imports and the management of foreign trade policies to preserve a reasonable and stable quality of international relations involving energy and related developments.

- The planning and implementation of Federal programs to enhance energy conservation and the development of those energy resources which will make the greatest contribution to easing the recent wave of inflation affecting energy supply.

- The management of the energy resources available to the nation in a manner to promote equity between States and the needs of present and future generations.

- Protection of environmental resources as provided under NEPA requirements.

Responsibilities to protect and enhance these national interests are, of course, posited with a number of Federal agencies, with the greatest focus lying with the new Department of Energy. The principal direct role of the NRC in these matters continues to be in the areas of measures to safeguard against the illicit diversion of nuclear materials; health and safety; and NEPA requirements. However, in the licensing review analysis of proposed nuclear power plants and alternative fuels, it has been deemed appropriate in meeting NEPA requirements to consider all of the above national interests along with regional and local interests. Indeed, in its ruling on an Environmental Impact Statement supporting a Federal decision on offshore oil leasing (Natural Resources Defense Council versus Morton), the U.S. Circuit Court observed that "the consideration of pertinent alternatives requires a weighing of numerous matters such as economics, foreign relations and national security" even though the agency preparing the statement has no direct responsibility for treating each of the impacts (Ref. 33).

A second reason for a continuing, if changing, Federal role in nuclear power plant licensing activities is the considerable experience accumulated in various aspects of nuclear energy and the licensing process. This experience goes back many years in terms of safety and national security matters, but even in environmental review it comprises many dozens of individual cases with variations of environmental settings, nuclear plant designs and cooling system alternatives, and socioeconomic and need-for-baseload facility issues as previously noted. Obviously, States desiring to increase their relative roles of responsibility for review and decision in the nuclear licensing process will need to acquire appropriate kinds of expertise and experience. The NRC and other Federal agencies can play a useful role in assisting these States in improving their capabilities to review and analyze needs and impacts associated with nuclear plant licensing with appropriate dispatch and effectiveness, including the often difficult public hearing phases.

A number of States are already well along in certain aspects of this learning process and are in a growing position to contribute to the store of information useful to the Federal licensing role and to other States. Still other States are barely beginning to engage in a more active licensing role and some, of course, display little or no interest in an expanded licensing role that involves a serious independent review of the applicant's proposed nuclear plant facilities, siting options and other alternatives in meeting similar requirements of a NEPA style of cost-benefit analysis currently practiced by the NRC in reaching licensing decisions.

Indeed, the highly complex and detailed technical information required for a review of nuclear safety and health aspects of a site-specific and technology-specific nature poses a difficult challenge for States who might wish to expand their role in this area. A recent letter (March 24, 1977) was addressed by former NRC Chairman Marcus Rowden to each State governor requesting their views on whether the present statutory arrangement of exclusive Federal control over radiation health and safety should be revised and, if so, what changes are desirable, with the following results (Ref. 3).

> Of the eighteen responses received to date, thirteen governors responded that no change in the current regulatory scheme is necessary. Reasons

cited for continuing Federal control are the complex nature of the facilities and the financial burden of establishing a technically competent State organization.

Two governors (Oregon and Arkansas) indicated that the Federal Government should act as a coordinator of State activities, set standards and establish an Agreement State concept for monitoring and enforcement authority around nuclear facilities. The governors of Connecticut and Michigan indicated that the States needed to play a more meaningful role and that Federal and State agencies should share decisions.

A number of Governors state support for the continuation of the Agreement State Program whereby the Commission relinquishes regulatory authority over source, byproduct and small quantities of special nuclear materials to the States.

No State indicated the necessity for a State to decide on the safety of a particular facility. The general consensus is that the States want to be involved in the process to assure themselves and their citizens that Federal performance is consistent with State values.

Regarding nonsafety aspects of nuclear power plant licensing, eight governors indicated that States should make the decisions related to need for power, land use, and the social and physical environment. Obviously, States' views on the role of the Federal Government in the broad sweep of review and decision functions related to various aspects of nuclear licensing are in a dynamic state of flux with sudden, sharp shifts to be expected for some and more slowly evolving changes for others.

This variability of States' interests and capabilities to perform effectively in different areas of nuclear licensing review and decisionmaking provides a third rationale for a continuing Federal role, namely to protect and to harmonize various public interests at the local, State, regional and national levels as associated with proposed nuclear power plants and their alternatives. This orchestration role of the Federal Government involves sharing leadership for improvements in the licensing process with those States which are willing and able to develop their potential and inherent advantages to play a strong and meaningful role in the nuclear licensing process as noted above.

One important area for a cooperative Federal-State role in the nuclear licensing and regulatory process is the previously noted objective of reducing the leadtimes and improving the predictability of planning, licensing and constructing nuclear plants. In this regard, a recent report (Ref. 4), notes that growing State and local government requirements or restrictions intended to reduce environmental impacts are "diametrically opposed to NRC's actions to shorten power plant leadtimes" and in six recent licensing actions, State requirements, rather than NRC requirements, have precluded utilities from getting earlier construction starts. Thus, there is a need for the NRC to engage in a harmonizing role to ensure that State and Federal regulatory and licensing activities will be cooperatively directed toward the desirable social purposes inherent in shortening power plant leadtimes, making the licensing process more stable and predictable as well as improving effectiveness in serving a variety of public interests.

PART II

DIVERSITY OF STATE PRACTICES IN NUCLEAR POWER PLANT LICENSING

1. INTRODUCTION

It is desirable that studied attempts to improve Federal-State cooperation in nuclear power plant licensing be made from a basis of understanding of the diversity of State practices and legal frameworks. In some instances, a number of States have already opted for vigorous licensing roles, others have elected to preserve relatively modest roles, while still others are in the throes of examining, or re-examining, what such roles should be. The general nature of environmental issues in nuclear licensing and the related roles of the NRC, the utility applicants, and other Federal and State agencies has been discussed in Part I. In this part a brief summary will be provided of some of the more indepth efforts of emergent State roles in a number of key areas of licensing review and decisionmaking as well as several contrasting State roles of modest dimensions. These program features are not offered as being necessarily models for imitation by other States, but principally because experience gained from their implementation could provide important insight for changing Federal-State relations. Special focus on program orientations and methodological practices in certain key areas of public controversy will likely be helpful in understanding the scope of issues dealt with, a qualitative notion of the level of effort involved, and, to some extent, the nature of problems resulting from the specific selection of methodologies and programmatic features. These examples will also provide some gleaning of the problems to be faced by NRC in achieving an appropriate blend of flexibility versus uniformity of procedures, guidelines and accepted methodological approaches when interfacing with environmental impact analyses provided by such a diversity of State practices.

The choices of analytical methodologies, the scoping of issues and other procedures open to the NRC, and hence to those States which desire to cooperate with the NRC in such licensing analyses, are constrained by the responsibilities and regulations imposed on the NRC by the National Environmental Policy Act of 1969 (NEPA), and by the Energy Reorganization Act of 1974. A detailed interpretation of the implementation of the procedural provisions of the NEPA has been provided recently by the Council on Environmental Quality (Ref. 34). Indeed, Sec. 1506.2(b) of the CEQ regulations provides that Federal agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and State and local requirements, unless the agencies are specifically barred from doing so by some other law. Other objectives and provisions of the CEQ regulations involving cooperation between Federal, State and local agencies in the preparation of environmental impact statements are found in twelve other sections. Part III, dealing with Federal Initiatives to Improve Federal-State Cooperation in Nuclear Power Plant Licensing, will explore further the requirements and potentialities of such cooperation set forth by the new CEQ regulations.

2. THE STATE OF MARYLAND POWER PLANT SITING PROGRAM

The State of Maryland has embarked on a comprehensive program of power plant siting and related environmental impact assessment through the passage of

the Maryland Power Plant Siting Act of 1971 which was amended in 1974. A number of its unique features are adopted from the program description provided by the Southern Interstate Nuclear Board (Ref. 35):

- The Power Plant Siting Act provides for (a) long-range planning by the Maryland Public Service Commission, the Department of Mental Health and Hygiene, the Department of Planning, the Department of Natural Resources, and electric utilities, (b) the preparation of environmental statements by the Department of Natural Resources, (c) the maintenance of an inventory of State-owned sites which are environmentally suitable for power plant construction, and (d) a comprehensive research and monitoring program.

- In the development of long-range plans, the electric utilities and the Maryland Public Service Commission are directed to develop forecasts for electric demand and supply. The resulting electric power plan will include proposed power plant sites for at least ten years and must be updated annually.

- Given these proposed sites, the Department of Natural Resources must prepare environmental statements sufficient to estimate the environmental impact of each proposed location. Proposed sites which appear environmentally best will be investigated in detail. Where the proposed sites are not owned by utilities, the State is empowered to acquire and hold them in standby, turning them over to the utilities upon request by either a long-term lease or direct sale. Temporary use of the State-owned sites, for example, as recreational areas, is permitted under certain circumstances.

- Amendments passed in 1974 pertain to: (a) zoning; (b) out-of-State surcharge; (c) research reimbursement to utilities for power plant site evaluation and related land use; and (d) one-stop procedures and appointment of a committee which includes a member for the Department of Natural Resources and the Public Service Commission to review and work of PPSP.

The Maryland Power Plant Siting Program (MPPSP), although administratively located in the Department of Natural Resources, is the lead agency for coordinating siting-related activities of six State Departments; Agriculture, Economic and Community Development, Health and Mental Hygiene, Natural Resources, Planning and Transportation. According to Paul Massicot, Director of the MPPSP, the Power Plant Siting Program is organized in four functional areas (Ref. 36):

(1) The Impact Assessment Program monitors, assesses and models the environmental impact of existing power plants.

(2) The Site Evaluation Program calculates the impact of future power plants at proposed sites for consideration at the Public Service Commission's hearings on Certificates of Public Convenience and Necessity and conducts a Detailed Site Investigation, including extensive field data collection, of all proposed power plant sites. The Site Evaluation work forms the basis of Program recommendations

to the Public Service Commission for conditions relating to the design, construction, and operation of a power plant that are necessary for the protection of the environment. This Program works closely with Federal agencies (particularly the Nuclear Regulatory Commission) in their activities relating to power plant siting and represents the State of Maryland in proceedings before these agencies.

(3) The Research Program is geared to developing an understanding of Maryland's environmental resources, and socioeconomic structure which is necessary to successfully site and operate power plants with a maximum benefit to society and minimum detriment to the ecosystem.

(4) The Site Acquisition Program whose purpose is to identify, investigate, acquire, and hold in the Site Bank, a minimum inventory of four sites deemed suitable for the construction and operation of power plants.

These program functions are accorded a substantial level of effort as a result of the funding provisions of the Siting Act. The law authorizes a surcharge to customer's electricity bills to cover the administrative and site acquisition expenses of the Power Plant Siting Program. The surcharge is not to exceed 0.3 mills per kilowatt-hour and the exact amount is decided annually. For example, the surcharge rate of 0.1 mills/kWh in FY 1973 produced Program revenues of about $3 million and the current surcharge of 0.15 mills/kWh has generated a budgetary level of $5,529,000 for FY 1979. The actual expenditures over the first six years of the Program have totaled approximately $27 million. Massicot (Ref. 36) feels the Program has saved the electric consumers of Maryland from unnecessary environmental safeguards. The current budget level represents a State staff of eight professionals and four secretaries plus a contractual structure involving approximately 150 scientists.

It is meaningful to review briefly some of the accomplishments and methodological features of the four functional areas of the Maryland Power Plant Siting Program. Under the Impact Assessment Program several studies have been conducted or are in progress as related to the evaluation of atmospheric and aquatic impacts of power plants in the State of Maryland. One such study was a three-year investigation involving the measuring and modeling of air pollution dispersion in order to improve state-of-the-art predictive capabilities. The investigation included extensive field work at Maryland power plants utilizing mobile and transportable monitoring instrumentation to track fossil plant plumes and the comparison of this data to the predictions of various air quality dispersion models.

Regarding aquatic impacts of power plants, one study involving several seasons of paired intake-outfall impact evaluations at the Morgantown Site on the Potomac Estuary has provided a basic understanding of how biocides and temperature stresses affect estuarine biota entrained in the cooling water flow of a conventional power plant. Other thrusts of study effort involve monitoring the effects of a large nuclear station directly on the Chesapeake Bay (Calvert Cliffs), and a comprehensive study of how striped bass utilize the Potomac. The latter work seeks to

find what factors are critical to sustained fishery yields, what portions of the river might be sensitive to power plant siting, and what plant design options are best suited to minimize any adverse impact in various regions of the estuary. Aquatic monitoring studies at the Calvert Cliffs Nuclear Plant on the Chesapeake Bay were funded jointly by the Maryland Power Plant Siting Program, the Baltimore Gas and Electric Company, and the U.S. Energy Research and Development Administration. The preliminary conclusion of the continuing monitoring program was that no changes in fish or shellfish abundance or composition attributed to the plant were detected in the Bay beyond the immediate area of cooling system outfalls (Ref. 37).

A number of water-oriented studies were initiated by the Maryland Power Plant Siting Program to serve the needs of the relicensing of Federal and State discharge permits in compliance with the Clean Water Act of 1977. Evaluation of 316(a) Cooling Tower Variance Applications pertaining to this Act requires assessing the water-related impacts of individual power plants. The MPPSP is meeting this requirement through the use of both existing national, State and utility data (both site-specific and generic), and, in some cases, collection of additional data by newer and more powerful field techniques. Part of this assessment requires knowing the significance of these impacts on the sustained yield and vitality of Maryland's tidewaters. The intensive monitoring effort at Calvert Cliffs has the additional purpose of flagging any significant ecological damage which may occur and of augmenting the company's data base in the limited time available for preparing the 316(a) variance application.

The Site Evaluation Program has likewise produced a number of studies, several of which focused on the Douglas Point Site proposed for nuclear power plant construction by the Potomac Electric Power Company. One early study was conducted under contract to the Maryland Power Plant Siting Program by the Department of Geography and Environmental Engineering of The Johns Hopkins University (Ref. 38). This pilot study developed an economic model to rank alternative power plant siting proposals, based on the proposed Douglas Point (nuclear) plant site. Its conceptual framework was highly complex, using 29 types of environmental resource services associated with the Chesapeake Bay and 25 related types of economic activities which were evaluated in terms of impacts for two fuel choices (coal and nuclear) at three site locations and a variety of cooling system modes and water intake options plus eight geographic locations for the resource-related activities. Part I of this pilot study explored different models for forecasting electricity demand growth for PEPCO's service area and for the State of Maryland as a whole and the District of Columbia. Three different sets of assumptions were employed concerning key parameters affecting residential electricity growth including increases or declines in the annual rate of growth in: (1) number of homes with electric water heat; (2) number of homes with electric space heating; (3) the percentage of homes without air conditioning; (4) per capita income; (5) population, (6) the percentage of homes in multiple family apartments; (7) percentage of homes in urban areas; and (8) the heating degree days is assumed to remain at the average seasonal norm. Statistical factors considered in developing nonresidential electric energy

energy demand forecasts included: (1) price of electricity, (2) price of alternative fuels; (3) size and growth of nonresidential market; (4) percentage distribution of economic activities by major sector; (5) percentage of housing units in multiple family dwellings which may be master-metered under nonresidential rates; and (6) climatic factors. The authors of the study caution that the forecast numbers are "illustrations only"; they are not actual projections but serve to demonstrate the type of electrical demand analysis which is in the process of being developed and refined.

In addition to the above, site evaluation reports on the Douglas Point Site on the Potomac River Estuary were prepared for the Maryland Power Plant Siting Program by the Applied Physics Laboratory and the Chesapeake Bay Institute of The Johns Hopkins University (Ref. 39). These reports evaluated the impacts which would be expected to result from the interactions between the environmental characteristics of the site and the engineering design and operating characteristics of the proposed power plant and certain alternatives of design. Areas of investigation and analysis included: aquatic ecology; hydrography (river flow, tides, salinity and temperature of the river, and circulation); cooling water requirements and cooling water intake and discharge systems; potential aquatic impact due to entrapment and impingement, entrainment, water borne effluents, and loss of marshland; potential impacts of proposed dredging and soil disposal; meteorology and local climatology; potential impacts of cooling tower air emissions relating to different designs of towers including ground level fog, visible plumes, icing, salt drift deposition, and aircraft safety; noise impacts; ground water impacts; dry land sedimentation and erosion control; transmission line impacts; radiation from normal operations; and site features affecting radiological accidents.

Also, efforts were made to streamline the regulatory process for licensing power plants. For example, the first phase of a joint hearing between the Maryland Public Service Commission and the U.S. Nuclear Regulatory Commission on the proposed Douglas Point power plant was held in the summer of 1976. It was felt that the joint hearing went smoothly and avoided considerable duplication of time and effort while providing a single forum for public participation.

The Research Program of the MPPSP is designed to identify and address basic problems and gaps in knowledge which may hamper progress in the Impact Assessment, Site Evaluation or Site Acquisition functions. An Environmental Research Guidance Committee (ERGC), consisting of representatives of State and Federal agencies, utilities, environmental groups, and academic institutions, has been established to identify research goals, rank them in suggested priority for funding, write "Suggested Scopes of Study" as a basis for requesting proposals to judge the technical merit of research proposals, and to evaluate the progress of research projects (Ref. 40). Examples of research areas being pursued include such diverse subjects as:

- Salt Draft Impact
- Thermal Stresses on Fish Eggs and Larvae
- Natural Draft Cooling Tower Salt Drift and Plume Behavior
- Estuarine Circulation Studies
- Feasibility Study of Fuel Switching Strategies for Maryland's Fossil Fueled Power Plants
- Field Studies to Delineate Aquatic Spawning and Nursery Areas
- Chemistry and Transport of Chlorination Products
- Biological Effects of Chlorination
- Fish Behavior Near Power Plant Intakes and Discharges
- Effects of Power Plants on Social and Economic Structures of Surrounding Area

Recognizing the tight certification and construction schedules that face the utilities, the law authorizes the Site Acquisition Program to make an alternative site available to a power company whose site has been judged unsuitable. The Site Acquisition Program is required to identify, investigate, and acquire these alternative power plant sites. Not only are there State environmental reviews of proposed nuclear power reactor sites, but $750,000 to $1,500,000 is expended per site in collecting, analyzing, and interpreting data which is considered before a Certificate of Public Convenience and Necessity is issued. When issued, the certificate contains stipulations necessary to meet standards and requirements relating to emissions, effluents, and other environmental effects such as noise, salt fallout, fogging, icing, consumptive water loss, design and types of intake and discharge structures and cooling configurations. An early decision was made that the Site Acquisition Program could not address radiological and reactor safety aspects, particularly the design-related ones, as effectively and efficiently as the Federal government (Ref. 36). On the other hand, the Program did not think that the NRC could match the local experience, reliability, and accuracy of their environmental and socio-economic deliberations without conducting an extremely expensive and duplicative detailed site investigation program.

A site acquisition study sponsored by the Maryland Power Plant Siting Program focused on detailed environmental assessments of four power plant sites on the eastern shore of the Chesapeake Bay as selected through a regional screening process from 66 candidate areas in 8 coastal countries (Ref. 41). The siting study was prepared for the Energy and Coastal

Zone Administration of the Maryland Department of Natural Resources by three consulting firms* and consisted of four stages:

(1) Regional screening of the entire eastern shore to find a reasonable number of candidate areas likely to contain desirable sites.

(2) Analysis of those selected candidate areas to find the more suitable candidate areas.

(3) Site selection from amorg these more suitable candidate areas.

(4) Detailed evaluation to allow comparison of the selected candidate sites.

The detailed environmental assessments for the four selected sites were based on three alternative power plant types: a 2400 MWe nuclear plant (two units @ 1200 MWe); a 1200 MWe coal-fired plant (two units @600 MWe) with barge fuel delivery; and a 1200 MWe coal-fired plant (two units @ 600 MWe) with rail fuel delivery. As a result of this relatively thorough regional screening process and detailed site assessment, the State of Maryland, acting under the Power Plant Siting Law, plans to acquire one of the sites to be held in reserve until needed by the Delmarva Power & Light Company and two of the four sites remain under consideration.

The Maryland Site Acquisition Program had earlier purchased the Elms site in St. Mary's County and the State of Maryland is negotiating with the General Services Administration of the U.S. Government for acquisition of the Bainbridge site to be added to the State Power Plant Site Bank. The Bainbridge site has approximately 1260 acres available for power plant construction east of Port Deposit, Maryland and was formerly the location of the Naval Training Center. The Philadelphia Electric Company is said to be interested in either joint or wholly-owned development of a generation plant at the Bainbridge Site (Ref. 42).

In addition to the above programs, the MPPSP publishes periodically a Power Plant Cumulative Environmental Impact Report (Ref. 42). This report contains trend data and projections of energy consumption for generating

*Dames & Moore was consulted to aid Rogers & Golden and Alan Mallach/Associates in stages 1 and 4. Rogers & Golden's responsibility was primarily environmental considerations: agriculture and soil-related features; surface water quality; shoreline erosion; tidal wetlands; nontidal wetlands; upland natural areas and outstanding natural features; endangered plants; aquatic resources; water fowl; upland wildlife; historic sites, archeological resources; and visual quality. Alan Mallach/Associates assessed economic and fiscal effects, including direct employment, secondary employment and income, immigration, housing demand, population increase, tax revenues generated, service costs, and State aid changes. Dames & Moore assessed access features, regional geology, foundations, flooding, cooling water costs and thermal effects, groundwater hydrology, demography, and potential hazards. Information available from other studies of the Power Plant Siting Program on air quality and cooling water dispersion was also used.

electricity in the State of Maryland, the Nation and the National Electric Reliability Council (NERC) Regions as well as related environmental impact data including socio-economic impacts. A number of specific recommendations for environmental policy are presented in the Report along with the admonition that:

> In some respects the Federal government is more of a hindrance than a help to the State in its effort to achieve the purpose of the Power Plant Siting Act. Actions of the various federal agencies and officials are unpredictable which leads to an undependable basis for long range Federal-State coordination.

Quite obviously, the major elements of unpredictability in the plans, policies and practices of both Federal and State agencies require cooperative attention, including a reconciliation of the sometimes conflicting interests of local, State and Federal jurisdictions in achieving just and meritorious solutions to the energy crisis for both present and future generations.

3. THE NEW YORK STATE PROGRAM OF POWER PLANT LICENSING

The State of New York presents another interesting example of growing State involvement in power plant licensing. The New York Environmental Conservation Law of 1970 provided a stronger focus of environmental protection efforts by creating the Department of Environmental Conservation (DEC). This new department has jurisdiction over air and water pollution as well as management programs for fish and wildlife, water, marine and mineral resources, including the development of a Statewide environmental plan (Ref. 35). The DEC program provides for a review of proposed nuclear power plants, operations inspections, and monitoring for radiation discharges.

The Act of 1970 also created a State Environmental Board with a 15-member interagency and citizen representation. The principal function of this board is to assist the DEC by offering a forum for the exchange of views and ideas relating to the protection of environmental quality. In addition, a Council of Environmental Advisors was created, its seven members appointed by the governor with the advice and consent of the State Senate. Their function is to advise the governor on a wide range of environmental policy and program matters, including the need for legislation to be responsive to the needs of present and future generations.

The Public Service Law of New York was amended in 1972 by adding Article VIII, "Siting of Major Steam Electric Generating Facilities". The preamble to Article VIII states that "it is essential to the public interest that meeting power demands and protecting the environment be regarded as equally important and that neither be subordinated to the other in any evaluation of the proposed construction of major steam electric generating facilities." Additionally, the purposes of the amendment focused on the high costs of licensing delays to ratepayers as well as the provision of adequate opportunity for public interest and environmental groups to participate in power plant siting decisions.

Designed as a one-stop siting law, Article VIII requires that prior to construction of a steam generating station (usually coal or nuclear fueled), an application must be made for a Certificate of Environmental Compatibility and Public Need. Administratively, the amendment established an Energy Commission to provide a comprehensive energy policy. The new Siting Board is composed of five members: The Chairman of the Public Service Commission (PSC), who also chairs the Siting Board; the Commissioner of Environmental Conservation; the Commissioner of Commerce; the Commissioner of Health; and "Ad Hoc" residents of the Judicial District where the proposed plant is to be sited. The Siting Law provides for hearings in the "primary proposed location" involving such issues as alternative sites and fuel options with a period of 180-210 days between the power plant application and the hearing.

The utility is required to provide, as part of the application, detailed site and facility data including analysis of alternative fuels, environmental impacts, dollar project costs and economic and long-range need justification based on demand growth projections and reserve margin requirements. The applicant must also provide $25,000 to local government for consultants. The Department of Environmental Conservation Hearing Officer reviews the application and may submit an independent report and recommendations. There is also a requirement for each electric corporation in the State to establish a 10-year facility construction, retirement and operating plan as well as projected research expenditures, all of which are subject to a public hearing. The State also conducts separate generic hearings on a biennial basis on nonconventional fuel sources under Chapter 386 of the Siting Law, which requires the Commission to formulate a comprehensive energy policy for the State and make recommendations for improved procedures for siting electric generating facilities.

Although a major purpose of the siting bill was to reduce licensing delays, there have been numerous criticisms of the law due to the fact that, until December 1977, no application had reached the Board decision stage (Ref. 43). According to information received from John Smolinsky of the State of New York Department of Public Service, the siting law was amended in 1978 to ensure expeditious consideration of new applications.* The key elements of the legislative changes are:

(1) Membership of the Board - The Commissioner of the State Energy Office replaces the Commissioner of Health.

(2) Pre-application procedures - Applicants are encouraged to consult with staffs of the Department of Public Service and Environmental Conservation regarding sampling methodology and study programs prior to implementation.

(3) Intervenor funds - The fund has been raised from $25,000 to $150,000.

*John Smolinsky, Acting Chief, Generating Facilities Planning and Certification Section, Office of Environmental Planning, State of New York Department of Public Service, personal communication to Miller Spangler of the U.S. Nuclear Regulatory Commission, April 24, 1979.

(4) Length of Cases - New applications must be completed in 24 months, and pending cases in 18 months.

(5) Alternatives - The new statute allows early consideration and determination of alternative sources of power and alternative sites before resolution of other siting issues.

The methodological approaches of the professional staffs of the New York Department of Public Service and the Department of Environmental Conservation in treating a variety of environmental impact issues, need for facility, and alternative sites and energy sources are found in a number of hearing testimonies presented before the State of New York Public Service Commission and the New York State Board on Electric Generation Siting and the Environment (Ref. 44-46). Outside organizations and consultants have also provided energy analyses and forecasts for use in hearings (Ref. 47, 48). In compliance with Section 149-b of Article VIII of the Public Service Law, multi-volume reports have been made available by the member electric systems of the New York Power Pool and the Empire State Electrical Energy Research Corporation (Ref. 49). These cover a host of subjects such as: projections of peak demand and energy requirements through 1996; load forecasting methodology; planned activities toward energy conservation; long range generation and transmission plans through 1991; environmental considerations; impact of a nuclear moratorium; economics of alternative fuels in the generation mix; fuel availability and environmental acceptability; and technical problems and research programs of the U.S. electrical utility industry and New York State utilities and the Empire State Electrical Energy Research Corporation.

The rules of procedure which implement certain provisions of Article VIII, require the submission by the applicant of complete economic, engineering and environmental data on a primary and at least one alternate site. The procedural requirement is understood as a pragmatic compromise with the implied statutory intent that the Siting Board weigh all possible alternatives, and all credible social costs, in reaching its decision (Ref. 50).

According to Cummings (Ref. 50) of the New York State Department of Public Service, the two-site policy has significant drawbacks: (1) since the initial selection of primary and alternate sites is unregulated, the quality of the sites designated in Article VIII applications has (in Staff's opinion) varied widely (2) since the Nuclear Regulatory Commission generally provides indepth environmental and safety review only for the primary site in an Article VIII case and a less detailed review for alternative sites, serious Federal regulatory delays and attendant facility cost escalation could result from Siting Board certification of an alternative site for a nuclear plant and this prospect tends to inhibit the Siting Board's freedom of action; (3) although the two-site policy affords an opportunity for intervenors to influence the Siting Board's final decision, the public remains excluded from participation in the initial selection of primary and alternate sites; and (4) complete environmental monitoring and analysis of an alternate site is necessarily expensive.

Cummings also notes that, since the early 1970's, the Staff has been interested in the concept of a statewide survey of potential steam-electric generating station sites as a tool for overcoming some of the shortcomings of the Article VIII two-site policy. Such a survey would consist of both a comprehensive set of criteria for defining the economic, engineering and environmental characteristics of optimum generation station sites and an efficient methodology for applying these criteria to a very large number of potential sites. The survey could be used on a case-by-case basis to systematically identify the optimum site for each new facility proposed for certification (conceivably this could allow modification or elimination of the requirement that full data be submitted on both a primary and an alternate site), or it could be used to establish a statewide pool of sites to be used for siting all generation required within a given period.

In November of 1975, (Opinion No. 75-13), the State of New York Public Service Commission required the member utilities of the New York Power Pool to prepare and submit by December 31, 1977, a set of economic and environmental criteria for selecting steam-electric power plant sites, and a statewide survey based on these criteria, of potential sites for power plants (Ref. 51). In response, the Power Pool has formulated a site survey divided into four stages, each of which contain a number of deferral and evaluative criteria. Stages I and II of the survey, which are now complete, identified 294 sites throughout the State that are considered suitable for further evaluation. The great majority of these sites are located in, or would draw cooling water from, the coastal zone. Stages III and IV of the survey have yet to be implemented.

On January 27, 1978 an order was promulgated by the New York PSC with the objective of winnowing down of the 294 sites to a limited group of preferable sites. This group would serve as the source of all new generating facility sites to be considered in Article VIII licensing cases during the next twenty to twenty-five years. It was felt that early identification of probable sites would facilitate early identification of issues important to communities likely to be impacted by siting decisions, and that early identification of sites would also greatly facilitate integration of electric system planning activities with local, regional and statewide planning programs, including in particular, the State's Coastal Zone Management Program.

The Public Service Commission felt that the economic and environmental criteria to be used in stages III and IV of the survey should be carefully and publicly examined and, as appropriate, modified and weighed (Ref. 57):

> Regardless of the technical merit of the individual criteria, the set of criteria, taken as a whole, expresses a number of complex social values and by the implicit or explicit weight given to each criteria, articulates the relative importance of these values. We do not believe that either the utility companies or the technical staff of the Department of Public Service has capacity to define

and compare these siting values without assistance. On the other hand, we recognize that many of the Power Pool's proposed criteria, although reflecting social values, are technical in nature. It is also true that the trade-offs and interconnections between individual siting criteria are often not apparent to the layman. We regard the review and weighting of these criteria as a particularly demanding and delicate task: a task that probably cannot be accomplished entirely within the context of a conventional adversary public hearing.

The Commission felt that the proper next step was to organize a three-day invitational workshop to address the matter of appropriate criteria for the site survey and selection process. Consequently, the Commission issued an order to the Staff of the Department of Public Service to make application to the National Oceanic and Atmospheric Administration for planning grant funds to plan and hold the proposed criteria review workshop and to undertake preliminary planning for this workshop pending receipt of the planning grant. As perceived by the Commission, participation in this workshop would include around thirty people. Department of Public Service Staff would serve as technical resource people; however, the workshop participants would be drawn from environmental groups, regional and county planning agencies, academia, consumer groups, etc. The emphasis in designating participants would be on the selection of individuals who represent distinct constituencies or points of view, and who have a sufficiently broad environmental or planning background to be able to quickly come to grips with site selection issues.

The Staff recognized the importance of an educational component in receiving public inputs and held no illusions as to the ease of accomplishing such a task. According to Cummings (Ref. 50):

> Unfortunately it is not immediately clear what constitutes a meaningful opportunity for the public to participate constructively in decisions on a necessarily complicated set of criteria. It appears that a public rulemaking hearing must be held before the Commission before the body adopts a specific set of criteria for the Power Pool survey. However, such a hearing would not, in itself, provide the input needed by the Commission. A conventional adversary hearing would probably harden and polarize the preconceived position of the participants rather than generate constructive dialogue.
>
> There are several critical issues that must be addressed by any project intended to improve public participation in the development and weighting of siting criteria:
>
> (1) It may be difficult to obtain input from a representative cross-section of groups affected by siting policies. While local or special interest groups already involved in individual power plant siting cases will quickly perceive the importance of participation, other affected groups may not be aware of the criteria review project or perceive its relevance to their interests. Therefore, a vigorous outreach element should be included in the project design.

(2) By the nature of the problem, a comprehensive set of power plant siting criteria will be diverse and complex. It will reflect issues that are relatively accessible to the layman and questions that are more technical in nature. It is likely that few potential participants will be informed on the full range of siting issues. A successful public input project must therefore include an educational component.

(3) It has been the Staff experience in participating in power plant licensing proceedings that most siting decisions, and certainly any set of comprehensive siting criteria, must confront the difficult problem of weighing trade-offs between various legitimate siting values. Participants in a public input project may not recognize the potential for internal contradictions in their own set of siting values, or the potential for conflict between their siting values and the values of other interest groups. While these problems can, to a degree, be addressed through education, it is important that the public participation project include an opportunity for participants to interact - to discover and explore these value conflicts.

(4) A successful public participation project should achieve more than just exploring systems of siting values. While complete consensus on siting criteria is highly unlikely, the identification of areas where broad agreement exists on the definition and weighting of siting criteria and the delineation of areas of irreconcilable differences are reasonable goals. This implies that the project must be carefully structured to lead to participants through a formal decision-making process.

Regarding the subject of Federal-State cooperation, the Staff of the State of New York Public Service Department and other Departments have recognized a need to work more closely with the NRC. Smolinsky (supra) notes that, in recent years, several attempts to eliminate duplication or regulatory processes have been made:

(1) Joint applications - Staffs of the New York Department of Public Service and NRC developed the Joint Working Paper for the Preparation of Environmental Reports for Generating Facilities in New York State which allows an applicant proposing a nuclear generating facility in New York State to file only one environmental report which will satisfy the requirements of both the NRC and the New York Siting Board.

(2) Joint hearings - Joint hearings were held in the Greene County case and are presently being negotiated in the New Haven case.

(3) EIS work for NRC - The staff of the Department of Public Service has agreed to perform the analytic work related to certain portions of the Draft and Final Environmental Impact Statements for the New Haven case and to act as NRC expert witnesses for these portions.

A fuller discussion of the objectives of such cooperative efforts and related problems will be discussed in Part III.

4. THE STATE OF CALIFORNIA ROLE IN ENERGY PLANNING AND POWER FACILITY SITING

Another example of a highly expanded State role in energy planning affecting nuclear power plant licensing is that of California. The Warren-Alquist State Energy Resources Conservation Act of May 1974 established a wide scope of energy policies as seen in the following sections (Ref. 52):

> 25001. The Legislature hereby finds and declares that electrical energy is essential to the health, safety and welfare of the people of this State and to the State economy, and that it is the responsibility of State government to ensure that a reliable supply of electrical energy is maintained at a level consistent with the need for such energy for protection of public health and safety, for promotion of the general welfare, and for environmental quality protection.
>
> 25002. The Legislature further finds and declares that the present rapid rate of growth in demand for electric energy is in part due to wasteful, uneconomic, inefficient and unnecessary uses of power and a continuation of this trend will result in serious depletion or irreversible commitment of energy, land and water resources, and potential threats to the State's environmental quality.
>
> 25003. The Legislature further finds and declares that in planning for future electrical generating and related transmission facilities State, regional and local plans for land use, urban expansion, transportation systems, environmental protection, and economic development should be considered.
>
> 25004. The Legislature further finds and declares that there is a pressing need to accelerate research and development into alternative sources of energy and into improved technology of design and siting of power facilities.
>
> 25005. The Legislature further finds and declares that prevention of delays and interruptions in the orderly provision of electrical energy, protection of environmental values, and conservation of energy resources require expanded authority and technical capability within State government.
>
> 25006. It is the policy of the State and the intent of the Legislature to establish and consolidate the State's responsibility for energy resources, for encouraging, developing and coordinating research and development into energy supply and demand problems, and for regulating electrical generating and related transmission facilities.

25007. It is further the policy of the State and the intent of the Legislature to employ a range of measures to reduce wasteful, uneconomical and unnecessary uses of energy, thereby reducing the rate of growth of energy consumption, prudently conserve energy resources, and assure Statewide environmental, public safety, and land use goals.

The California Energy Resources Conservation and Development Commission (ERCDC) was established by the Act to develop and implement programs responsive to these policies. The Commission consists of five members appointed by the Governor with consent of the Senate. The Secretary of the Resources Agency and the President of the PUC serve as ex officio members of the Energy Resources Conservation and Development Commission.

The ERCDC is responsible for compilation of all standards to be met in designing, siting and operating facilities in the State (Ref. 43). ERCDC also prescribes the form and content of applications for facilities; formally acts to approve or disapprove applications; prepares integrated plans specifying actions to be taken in the event of an emergency; evaluates policies governing the establishment of rates for electric power; serves as a State government repository for the collection and storage of data and information on all forms of energy supply and relative subjects.

The Commission's organization is highly structured along the functional lines of responsibilities the Act requires it to perform. Reporting to the Executive Director in the early years of its performance were four divisions: (i) the Facility Siting Division, (ii) the Conservation Division, (iii) the Alternatives Division, and (iv) the Energy Assessment Division. According to Ross Deter of the California ERCDC, several changes have been made in the organization of these divisions.* There is no longer a Facility Siting Division. This Division, along with all environmental persons in the Commission, were reorganized into one unit. The Commission now has an Engineering and Environmental Division which reviews power plant licensing applications for both engineering and environmental issues and prepares the appropriate environmental documentation. The Division also analyzes the engineering and environmental feasibility of utility resource plans and alternative methods of generating electricity; assesses the environmental impact of new technologies and conservation measures; and prepares all environmental impact reports (EIRs) for the Commission. The Conservation Division remains intact. The Alternative Division remains intact. It, however, has a new name, Development Division. A new organizational unit has been set up which is called the Office of Projects Administration. This office reports directly to the Executive Director and houses Project Managers and administrative support units for the Commission's regulatory activities.

In view of the relatively high frequency and controversy of need for power issues in NRC environmental hearings, as noted in Part I, it is particularly instructive to examine briefly the detailed structure of energy planning

*E. Ross Deter, Energy Assessment Division, California Energy Resources Conservation and Development Commission, personal communication to Miller Spangler of the U.S. Nuclear Regulatory Commission, May 4, 1979.

and forecasting required of the ERCDC by the Act (Ref. 52) as set forth in the following section:

> 25300. Every electric utility in the State shall prepare and transmit to the Commission within one year after the effective date of this division, and every two years thereafter, a report specifying 5-, 10- and 20-year forecasts or assessments of loads and resources for its service area. The report shall set forth the facilities which, as determined by the electric utility, will be required to supply electric power during the forecast or assessment periods. The report shall be in a form specified by the Commission and shall include all of the following:
>
> (a) A tabulation of estimated peak loads, resources, and reserve margins for each year during the 5- and 10-year forecast or assessment periods, and an estimate of peak load, resources, and reserve margins for the last year in the 20-year forecast or assessment period.
>
> (b) A list of existing electric generating plants in service, with a description of planned and potential generating capacity at existing sites.
>
> (c) A list of facilities which will be needed to serve additional electrical requirements identified in the forecasts or assessments, the general location of such facilities, and the anticipated types of fuel to be utilized in the proposed facilities.
>
> (d) A description of additional system capacity which might be achieved through, among other things, improvements in (1) generating or transmission efficiency, (2) importation of power, (3) interstate or interregional pooling, and (4) other improvements in efficiencies of operation.
>
> (e) An estimation of the availability and cost of fuel resources for the 5-, 10- and 20-year forecast or assessment periods with a statement by the electric utility describing firm commitments for supplies of fuel required during the forecast or assessment periods.
>
> (f) An annual load duration curve and a forecast of anticipated peak loads for each forecast or assessment period for the residential, commercial, industrial, and such other major demand sectors in the service area of the electric utility as the Commission shall determine.
>
> (g) A description of projected population growth, urban development, industrial expansion, and other growth factors influencing increased demand for electric energy and the bases for such projections.

While the above requirements acknowledge the continued lead role of electric utilities and specify the form and content of planning and forecasting inputs to the licensing review and energy planning functions of the CERCDC, the Act (Ref. 52) also provides for a key role of ERCDC in developing a

common forecasting methodology through the following section which states, in part:

> 25301. The Commission shall establish and every electric utility shall utilize, for purposes of the report, a common methodology for preparing forecasts of future loads and resources. After applying the Commission's established methodology to the mandatory elements of the report specified in Section 25300, any electric utility may transmit to the Commission supplementary information and forecasts based upon an alternative methodology. If such alternate methodology is employed, the electric utility shall fully describe the data and other components of the methodology, and shall specify the reasons why the approach is considered more accurate than that established by the Commission.

Moreover, other important forecasting responsibilities are assigned to the ERCDC in the preparation of a preliminary report as specified by the following section:

> 25305. Within six months after receipt of the reports specified in Section 25300, the Commission shall prepare and distribute a preliminary report, setting forth its findings and conclusions regarding the accuracy and acceptability of the electric utilities' forecasts. The report shall be based upon information and views presented in the comments received under Section 25303 and the Commission's independent analysis, and shall contain all of the following:
>
> (a) The Commission's evaluation of the probable service area and Statewide, environmental and economic impact and the health and safety aspects of constructing and operating the facilities proposed by the electric utilities and a description of the measures considered necessary by the Commission to avoid or ameliorate any adverse impacts.
>
> (b) Any proposed alternative methods for meeting the electrical energy requirements identified by the electric utilities.
>
> (c) The anticipated 5- and 10-year level of demand for energy to be utilized as a basis for certification of facilities, and an anticipated 20-year level of demand for energy to be utilized as a basis for recommending energy conservation policies and actions.
>
> (d) Identification, on a Statewide and service area basis, of required electric facilities consistent with the anticipated level of demand, both before and after consideration of the possible impacts of recommended conservation measures.
>
> (e) An analysis and evaluation of the means by which the projected annual rate of demand growth of electrical energy may be reduced, together with an estimate of the amount of such reduction to be obtained by each of the means analyzed and evaluated, including a statement of the impact of such reduction on the factors reviewed by the Commission set forth in Section 25304 and subdivision (a) of this section.

Following public hearings on this preliminary report and within 12 months after receipt of the utilities' reports required in Section 25300, a final report shall be included within the Commission's biennial report to the governor and the legislature which will present its conclusions on "the accuracy and acceptability of the electric utilities' forecasts and on the Commission's independent analyses and evaluations, as specified in Section 25305."

In conformance with these and other provisions of the Act, the first biennial report has now been published. Of particular interest in Volume 2, which deals with Electricity Forecasting and Planning, are (1) the inclusion of a wide range of high and low forecasts of electricity sales and peak demand forecasts along with the Commission-adopted forecasts for each of five major utilities, and (2) a separate section presenting staff-prepared "conditional forecasts" of Statewide residential sales which include specific high and low scenario assumptions for selected causal factors (Ref. 53). Of methodological interest are the conditional forecasts for each of the scenario assumptions as shown in Table 1.

The ambitious undertaking represented in the tasks and procedures that produce this forecasting report were not without its difficulties as seen in the following statement on limitations of the report (Ref. 53, pp. xv, xvi):

> This first Electricity Forecasting and Planning Report has been produced during the Commission's first two years of operation, a period of flux which has compounded the difficulties of designing and implementing a fundamentally new approach to electricity planning. The Act initially required the utilities' reports to be submitted by May 21, 1975, but this date was later extended by Legislation (SB 336) to March 1, 1976. Further difficulties with implementing a common forecasting methodology resulted in even later final filing dates for the utility submissions.
>
> Available data and traditional methods of forecasting and planning have proven inadequate for the objectives of this report, and the analytic tools required, particularly in such areas as conservation and environmental impact assessment, have not yet been fully developed. The 1979 Biennial Report will reflect substantial improvements in the scope and depth of analysis as utility data requirements and staff methodologies are more clearly and fully specified and as experience improves utility and Commission work.

The experimental nature and continuing challenges encountered in the process of developing the common forecasting model prescribed by the Act are set forth in a conceptualization paper prepared in June 1977 by the staff of the Energy Assessment Division (Ref. 54):

> In December 1975, the Energy Commission adopted a common forecasting methodology (CFM) developed by a consultant, Economic Sciences Corporation (ESC). This methodology was based on a state-of-the-art of energy forecasting techniques and was divided into a macroeconomic interim method (using existing data sources for immediate

TABLE 2

SENSITIVITY OF STATEWIDE FORECASTS OF RESIDENTIAL ELECTRICITY SALES FOR 1980-1995 AS PREPARED BY THE CALIFORNIA ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION*
(Millions of kilowatt-hours)

Scenario	1980	1985	1990	1995
Nominal	54,161	61,105	68,648	76,681
Alternative Assumption				
1. E-0 Population and Household Projection	52,895	55,861	59,551	63,663
2. E-275 Population and Household Projection	57,164	73,060	83,003	102,879
3. No New Natural Gas Hook-Ups After 1980 and Resistance Heating	54,161	71,086	86,687	101,872
4. No New Natural Gas Hook-Ups After 1980 and Solar Heating	54,161	61,727	69,426	77,794
5. Continued Natural Gas and Solar Heating	54,161	58,237	63,554	69,800
6. All Natural Gas After 1980	54,161	58,267	63,499	69,415
7. No New Energy Intensive Appliance Technology	53,960	60,075	65,903	71,460
8. Water Heater Retrofit and Flow Restrictors	53,794	60,371	67,878	75,881
9. Ceiling Retrofit and Thermostat Setback	53,914	60,806	68,362	76,407
10. Continued Energy Crisis Induced Conservation Ethic	51,345	57,928	65,078	72,694

*Source: Electricity Forecasting and Planning, Vol. 2, p. 80 (Ref. 53)

use) and a microeconomic comprehensive methodology (requiring additional data sources to be used as the data become available).

Since the development of a common forecasting methodology for electricity demand had not been attempted in any other State, all participants began what was to be a major experiment and a learning experience. There was no way of completely anticipating the nature of the results that would emerge.

The methodology consisted of two basic sectors: an economic sector and an electricity sector. The model related utility service area electricity consumption to energy prices and to real incomes and employment levels which were determined by the economic sector of the model.

After March 1976, when most utilities had submitted their forecasts using the CFM, it became clear that the entire model could not be completely implemented in each of the five major service areas. Essentially, the CERCDC staff and the utilities learned that the models and theories upon which the CFM was based provided an important starting point for developing the explicit procedures needed to forecast energy demand. The CFM was by no means the endpoint in developing energy forecasts...

One clear message that utilities, the Energy Commission staff, and the public obtained from the first two-year process was that forecasting is an art as well as a science. Throughout the country experts are continually updating procedures using new data and methods. The Commission should at no point be locked into a specific procedure that cannot be modified as new information or analysis is made available. It is in this light that the staff will be proposing to make some substantial changes in the Commission adopted regulations for forecasting energy demand.

The EAD staff weighed the benefits and disadvantages of the following two basic options for developing CFM II and recommended the first (Ref. 54, p. 4):

(1) Option 1 would direct the utilities to develop their own forecasting equations and precise procedures to forecast future electricity demands based on detailed requirements set forth by the Commission of causal factors to be included in the analysis. Workshops involving utility and Commission staff would work out difficulties which could lead to commonly accepted procedures.

(2) Option 2 is for the Demand Assessment Office staff of the EAD to develop functional forms for forecasting electricity demand for each sector and utility requiring additional staffing and time to complete.

Regarding research and development, the ERCDC is authorized to conduct such a program relating to energy supply, consumption, conservation and the technology of siting facilities. Beginning with the 1976-77 fiscal year, the Commission is required to submit to the Governor for inclusion in the State budget an integrated program of research and development and technical assessment projects.

On June 8, 1976, the voters of California rejected by two-to-one Proposition 15, called the "Nuclear Power Plant Initiative." This legislation was placed on the ballot for popular approval in early 1975 by a petition with over 500,000 signatures (Ref. 43). The Initiative would have provided for cessation of nuclear power plant construction and cut backs in output unless: (1) The Price-Anderson $560 million liability limit were removed by Congress or waiver; (2) The Legislature determined by a two-thirds majority vote that reactor safety systems and radioactive waste storage had been adequately demonstrated by 1981.

However, as described by Energy Facility Siting in the United States (Ref. 43) Governor Edmund G. Brown, Jr. signed three bills on June 3, 1976, that make further nuclear development in California subject to some important conditions. Introduced by Assemblyman Charles Warren's Committee on Resources, Land Use, and Energy, this legislative package, as enacted, provides for review by the ERCDC of certain aspects of nuclear power plant operations. Specifically, the bills prohibit the further construction of nuclear facilities until the Commission has studied and concluded that (1) acceptable radioactive waste reprocessing technology exists and is available in adequate quantities (AB 2820); (2) final reactor waste disposal means has been demonstrated (AB 2822); and (3) underground reactor construction is or is not feasible and desirable (AB 2821).

The first two findings may be returned to the Commission for further study by a majority vote of either house of the Legislature during a period of 100 legislative days following their submission. The Legislature may declare its findings of the subsequent report of the Commission null and void only by statutory action of both houses, again within 100 legislative days. All three bills specifically exempt from their provisions those plants for which substantial expenditures have been incurred or obligated, including but not limited to, the San Onofre 2 and 3 and Diablo Canyon 1 and 2 units. Specifically not named are the San Diego Gas and Electric Company's Sundesert project and the Los Angeles Department of Water and Power's San Joaquin facility. An aggregate of $55 million has been spent on these sites. These three acts are the first of their kind in the Nation, requiring specific conclusions of State government on nuclear issues before further nuclear development can proceed.

A fourth bill, proposed but never reported from the Warren Committee, would have provided that the $560 million Price-Anderson liability limit would have to be removed before plants could operate in California.

Subsequently, another act (AB 1852) was signed by Governor Edmund G. Brown, Jr. on September 28, 1977, to take effect immediately as an urgency statute

(Ref. 43). Existing law prohibits any nuclear fission thermal power plant requiring the reprocessing of fuel rods, from being certified by the Commission until the State Energy Resources Conservation and Development Commission determines that: (1) technology exists for the construction and operation of nuclear fuel rod reprocessing plants; (2) technology exists for the disposal of high level nuclear waste; (3) the Legislature does not find the above to be false after 100 Legislative days have been passed since such findings of the Commission have been filed. This bill requires the Commission to relate to the Legislature if these findings can be made at this time. If they cannot, the Commission is required to submit a recommendation as to whether any such facility should be exempt. The Commission's decision must reach the Legislature by no later than January 16, 1978.

The constitutionality of several of the above acts were challenged in the courts. The following excerpts from Nuclear News describe the nature and status of these court challenges (Ref. 55):

> The authority of an individual state to enact statutes that conflict with or preempt federal nuclear authority was denied in federal court on March 6. A suit filed by the Pacific Legal Foundation last October to challenge three amendments to the Warren-Alquist Act in California led to a decision by the U.S. District Court in San Diego that declared two of the amendments moot and the third unconstitutional because it usurps authority held solely by the federal government via the Atomic Energy Act.
>
> The San Diego suit was filed October 2, 1978, the same day that Pacific Gas and Electric Company and Southern California Edison Company challenged the constitutionality of California's nuclear laws in federal court in Sacramento. The latter suit, however, is aimed not at specific amendments, but at all of the 1976 laws that deal with nuclear power plant regulation and licensing. The Sacramento trial is expected to continue for some time; intervention petitions were to be considered in a hearing March 19, and on April 30 the court will hear a motion from the state Energy Resources Conservation and Development Commission (ERCDC) to dismiss the suit.
>
> The three amendments to Warren-Alquist dealt with long-term waste storage, fuel reprocessing, and underground construction of nuclear plants. The court found the latter two issues to be inapplicable, because reprocessing has been proscribed and the state's own fact-finding work has dismissed underground siting. Judge William Enright ruled that any decision to withhold nuclear construction pending waste management feasibility demonstration should come from the federal realm, by the supremacy clause in the U.S. Constitution. ERCDC chairman Richard D. Maullin was expected to recommend that the Commission appeal the March 6 decision.

5. THE FLORIDA ELECTRIC POWER PLANT SITING ACT

Although the energy planning and power plant siting laws of Maryland, New York, and California have striking differences in objectives and implementation features, they share in common the characteristics of vigorous

involvement in siting and licensing decisions affecting nuclear power plant construction and operation. It would be wrong to leave the impression that this is a typical characteristic of the situation in most other States. A somewhat more simplified regime is that of the Florida Electric Power Plant Siting Act which took effect on July 1, 1973. The main purpose of the Act was to develop a centralized and coordinated system for review of power plant siting permit applications (Ref. 43). The Florida Environmental Reorganization Act of 1975 created the Environmental Regulation Commission and presented the Department of Environmental Regulation with one-stop authority for power plant siting certification. The Florida Electric Power Plant Siting Act was amended in 1976 to achieve a more specific timetable for agency decisions or inputs to decisions. Among provisions for structural change were the requirement of the Division of State Planning to assess compliance of a power plant site with the State Comprehensive Plan and the inclusion of Water Management Districts as a statutory party.

A comprehensive application must be filed by a utility proposing to construct a power plant which provides detailed information on the need for power, impacts on air and water quality, land use and other environmental effects and safeguards. The review process is described by Hopping as follows (Reg. 56):

> Within seven months of the receipt of an application, the Department of Environmental Regulation prepares: (1) a written analysis containing its environmental analysis, the reports of the various affected agencies and the comments of local, regional, Federal and State agencies, and (2) proposed conditions for the construction and operation of the facilities ("Conditions of Certification"). The proposed Conditions of Certification and the written analysis become the basis of a public hearing held before an independent administrative hearing officer. Such hearings are conducted in an open and highly publicized manner near the site of the plant. The Act provides that any environmental groups or substantially affected citizens may be parties to the proceedings as well as any local, State or regional agency. All permitting issues raised by the rules or regulations of any affected agency are considered at this hearing. Agencies from whose rules the utility seeks a variance or exemption must be made a party to the proceeding. At the certification hearing, all issues about the licensing of the plant which are contested by any party are fully aired and the hearing officer, based on the evidence, enters a recommended order which contains his findings of fact, conclusions of law and the recommended Conditions of Certification. The hearing officer's recommended order is then submitted to the Governor and Cabinet* who enter the State's final decision in the form of a Certification Order and Conditions of Certification. The Certification, once signed by the Governor, constitutes

*The Licensing Board consists of the Governor and Cabinet which are the State's highest elected officials: Secretary of State, Attorney General, Comptroller, Treasurer, Commissioner of Education, and Commissioner of Agriculture.

the State's sole license as to the approval of the site and the construction and operation of the proposed electrical power plant and its associated facilities.

Since the adoption of the Act in 1973, ten power plants with an aggregate of about 6000 megawatts of electrical generating capacity have been licensed involving oil, nuclear, coal, refuse and combined cycle systems. The average time from application filing to certification was only 11.6 months.

6. STATE OF IOWA POWER FACILITY SITING LAW

To complete the spectrum of examples of how states differ in their approaches to power plant licensing, it is instructive to examine how a State with a limited budget seeks to expedite licensing while being attentive to environmental protection and arranging for public participation. The following brief description of Iowa's licensing process reflecting the key features of the Iowa power facility siting law (Chapter 476A, Code of Iowa, 1977) was provided by Maurice Van Nostrand, Chairman of the Iowa State Commerce Commission:*

(1) Any persons proposing to build a new electric power generation facility larger than 100 MW or a "significant alteration" to any facility of that size must, after January 1, 1977, receive a State certification before commencing such construction.

(2) Under our enabling legislation, a one-stop licensing process was contemplated. Acting as an "umbrella" agency, the Commerce Commission has entered into an intragency agreement with the State's Department of Environmental Quality, and is now completing similar agreements with other State agencies with regulatory interest in such facilities. These agencies will review those portions of the application regarding their area of regulatory authority and appear on the record at our Commission's hearing to indicate whether the applicant is in compliance with that agency's licensing or permit requirements. In this sense, there is a highly structured interaction with the State's environmental regulatory agency.

(3) The decision to issue a certificate for a facility rests solely with our Commission; there is no interdisciplinary board composed of representatives of the other regulatory agencies.

(4) In addition to the assessment by the Department of Environmental Quality of the proposed facility's compliance with minimum environmental standards, our Commission's determination must by statute include consideration of the environmental impact of the project.

(5) A public hearing on the application is required under the statute, and it must be held in the county where the plant is to be built.

*Maurice Van Nostrand, Chairman, Iowa State Commerce Commission, personal communication to Miller Spangler of the U.S. Nuclear Regulatory Commission, March 30, 1978.

(6) No long-range forecast is explicitly required under our statute, but the need for such an analysis on a state-wide basis seems essential to properly assess the need for the added generation. We are now developing rules to require all major utilities to submit such long range energy plans.

With the objective of developing a sound method for assessing and comparing energy demand projections presented by applicants and other parties in Iowa's plant licensing proceedings, the Commerce Commission has retained a national consulting firm to work with their staff in designing models to project the system peak, total energy requirements, and load duration curve for several of Iowa's largest utilities.

Although no plans for nuclear plants have been announced in Iowa, three applications for certificates are pending under these regulations, all involving coal-fired generating plants. In 1976, prior to the passage of the licensing law, an amendment was offered in both the House and Senate which, if had not been defeated, would have required a utility proposing to build a nuclear power plant to present information as to where the spent fuel would be processed (Ref. 43). On February 22, 1979 a new bill (H-502) was introduced which, if passed, would prohibit the construction of any nuclear power plant in the State for a five-year period from the effective date of the Act.

Regarding public participation in power plant licensing, Van Nostrand (supra) provides the following views:

> The state and federal agencies reviewing power plant applications do not need ways to increase public participation, but rather ways to increase effective public participation. Too often, misdirected or confused representation of intervening parties contributes greatly to the delay and expense of proceeding. While some of this problem may be traced to efforts whose sole purpose is delay, I find much of the problem relates directly to poor information or misunderstanding of crucial legal or technical requirements in the review process.
>
> Prehearing conferences and informational meetings before the hearing are being used in the our state to better coordinate the efforts of the several state agencies involved, to better inform representatives of the public of the true nature of the proceedings, and to better define and narrow the issues of fact or law that remain for resolution at the hearing. These steps reduce misunderstandings and actually serve to expedite the overall proceeding.

7. OTHER COMMENTS ON STATE AND REGIONAL EFFORTS AFFECTING ENERGY PLANNING AND POWER PLANT LICENSING

According to Vickie Evans, at least 7 of the 39 present or projected nuclear power States require State-prepared Environmental Impact Statements for

power facilities: California, Massachusetts, Michigan, Minnesota, Washington, Wisconsin and the Commonwealth of Puerto Rico.* Variability in State energy planning programs and licensing practices is a source of considerable complexity and challenge in improving Federal-State cooperation in the licensing of nuclear power plants. The NRC study team which developed a preliminary staff report on Improving Regulatory Effectiveness in Federal/State Siting Actions made the following observations (Ref. 3):

1. There is a high degree of variation in siting procedures among the States. As in other areas of public policy development, the States in their energy facility siting activities are serving as a laboratory for the development of new styles. In any plan to increase the effectiveness of coordinated State/regional/Federal siting activity, a significant degree of flexibility to accommodate continuing variations should be provided. Only those provisions necessary to assure compliance with Federal law should be made an absolute requirement.

2. The large capacity of nuclear and fossil base-load generation stations now being planned is in many cases intended to serve the incremental growth needs of areas of more than one State. This situation presents a problem in balancing costs and benefits for the host State acting alone.

3. The large variation in State siting practices may serve to encourage States, or regional associations of States, to develop model State siting laws which would facilitate coordination between States and between the Federal Government and States. A chief characteristic of a siting plan that facilitates State-to-State and State-to-Federal coordination is internal coordination among agencies, so there can be a single point of contact between States and between a State and the Federal Government, in other words, one-stop licensing.

4. Some States may certify a new base-load generation site so infrequently that they cannot justify assigning significant staff resources to energy facility siting regulation. Regional (interstate) and Federal/State arrangements must accommodate States that wish to limit their degree of involvement.

Some of the variations in major provisions of power facility laws for different States are shown in Figure 8 as provided by Sheldon Schwartz.** Obviously, further additions to this list of States with active siting and environmental

*Unpublished paper presented at the Winter Meeting of the American Nuclear Society, November 16-21, 1975 on "State Environmental Impact Statement Requirements and Power Facility Licensing."

**Sheldon A. Schwartz, Office of State Programs, U.S. NRC. Unpublished paper on "State Involvement on Siting Power Plants," presented at the Second Annual Meeting of the Advisory Committee on Energy Facility Siting sponsored by the MITRE Corporation, McLean, VA, October 24, 1975.

Figure 8

VARIATIONS IN MAJOR PROVISIONS OF POWER FACILITY LAWS BY STATE*
(As of October 1975)**

STATE	Site Permit Required	One-Stop Licensing	Interdisciplinary Board	Environmental Assessment	Consideration of Alternative Sites	Consulation with Environmental Agencies	Public Hearing	Public Member on Regul. Bd.	Long-Range Forecast Required
Arizona	o	o	o	o		o	o	o	o
Arkansas	o			o		o	o		o
California	o	o	o	o	o		o	o	o
Connecticut	o	o	o	o	o	o	o	o	o
Delaware	o		A	o	o		o	A	
Florida	o	o		o	o	o	o		o
Kentucky	o	o		o		o	o		
Maine	o						D	o	
Maryland	o	o		o	o	o	o		o
Massachusetts	o	o	o	o		o	o	o	o
Minnesota	o	o	o	o	o	o	o	o	o
Montana	o	o	o	o	o	o	o		o
Nevada	o	o		o	o	o	o		
New Hampshire	o	o	o	o	o	o	o		o
New Jersey				o	o		o		
New Mexico	o	o							
New York	o	o		o	o			o	
Ohio	o	o	o	o	o	o	o	o	o
Oregon	o	o		o		o	o	o	o
South Carolina	o	o					o		
Vermont	o	o		o			R		
Virginia	o					o	o		
Washington	o	o	o	o	o	o	o	o	
Wisconsin	o			o		o	o		o

* Source: Sheldon A. Schwartz (1975)

A - Interdisciplinary Appeals Board
D - Discretionary
R - By Request

** Since 1975, five states have passed siting laws with one-stop licensing: Iowa, Kansas, N. Dakota, S. Dakota, and Wyoming.

programs involving power facilities can be expected as well as further legal and program formulations for the States presently involved. Ultimately, four or five basic patterns with lesser variations may emerge which will make Federal-State cooperation more manageable and effective once a period of transition and learning has been surmounted, encouraged perhaps by Federal legislation of a facilitating bent.

Growing regional cooperation between States can also improve uniformity and greater effectiveness of State licensing action with commensurate benefits for improved Federal-State cooperation in nuclear licensing activities. This regional coordination in energy planning and related power plant licensing activities can take numerous forms. One of these forms is through regional groupings of States pooling financial resources to provide consulting services and regional studies related to energy planning and licensing problems such as the Southern States Energy Board (SSEB) and the Western Interstate Electric Board (WIEB). The SSEB's membership consists of the following 17 States: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virginia and West Virginia. WIEB's 12 member States include: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming.

Three northwestern States (Washington, Oregon and Idaho), which already have important power pooling relationships, have joined together to form the Pacific Northwest Regional Commission, comprised of the three State governors and a Federal co-chairman. During 1977 their program encompassed publication of 11 study modules of interrelated energy reports which are integrated into the Northwest Energy Policy Project. One of these studies is directed toward an energy demand modeling and forecasting effort which provides forecasts through 2000 AD for each of the member States for growth in demand for electricity, coal, gas and oil under varying scenario assumptions (Ref. 57). Other studies include energy conservation policy (opportunities and social impacts), energy supply and environmental impacts (conventional and unconventional sources), contingency planning, institutional constraints and opportunities, novel or unconventional aspects of energy policy choices, and integrated policy analysis.

Another kind of regional interest for cooperative efforts between States in energy facility siting stems from the water resource requirements of energy developments and electric power plants in particular. An important example of this kind is the policy study on comprehensive aspects of energy facility siting recently performed by the Great Lakes Basin Commission for the Office of Coastal Zone Management of NOAA (Ref. 58). An interesting feature of the study in regard to land, fuel and water requirements for additional electrical power facilities through the period 1975-1995 is the use of three widely differing scenario assumptions for the ratios of coal and nuclear units to meet projected demand.

Many of the above studies, while highly valuable, fall into the category of "soft" planning exercises. That is to say, the data, analyses and forecasts prepared can provide important inputs to the "hard" facility planning

which compares and decides on options involving the specifics of site location, fuel type, facility size and design, mitigative measures, the proposed timings of construction and operation and a host of other important details to meet Federal and State licensing requirements. Studies of the latter detailed kind can generally be performed more appropriately by the utilities which have the staff and the financial resources to hire expert consulting services to develop firm energy facility plans that must meet the increasingly demanding legal requirements of licensing and independent review.

An important indirect benefit of regional forecasting and soft planning studies is that these encourage early public understanding of energy and resource development opportunities and associated impacts and problems while, by the same token, providing an awareness of the advantages of regional cooperation in facility siting and resource utilization and thus to facilitate greater cooperation between States at the hard planning stage. This serves the psychological needs of the public and affected governmental agencies to have ample time to mull over the pros and cons of large-scale developmental actions and so to resolve uncertainties in their mind sufficiently to be willing to accept the associated risks. The incubation process for public acceptance is not generally satisfactory within the limited time frame of licensing actions and where penalties of delay are more costly to the consumer public than in the soft planning and prelicensing stages when relatively limited investments have been made. For example, the expenditure of $10-$20 million for site acquisition and soft and hard planning studies by the time a construction permit is applied for is around 1% to 2% of the projected capital cost of a 1000 MWe nuclear plant coming online in the mid-1980s.

There are some publicly available studies of power plant facility planning involving more than one State by agencies with hard planning regional responsibility. One notable example is that of the New England Power Pool (NEPOOL), a regional organization established in 1971 by the area's utilities to enhance the reliability and improve the economics of bulk power supply. A detailed description of the energy forecasting and planning process of NEPOOL and the most recent facility expansion plans is found in a 1976 technical report prepared by the New England Regional Commission (Ref. 59).

Another example of a contrasting sort is that of a comparative study of coal and nuclear generating options for the Pacific Northwest prepared by the Fuel and Technical Studies Department of the Washington Public Power Supply System (Ref. 60). In this preliminary study, assisted by Ebasco, explicit single-valued planning parameters were assumed as to plant size, operational date, plant capacity factor, escalation rate, interest rate, and fixed charge rate. Specific estimates were prepared for capital cost, fuel cost, O&M cost, transmission cost, cancellation cost, decommissioning cost, and environmental and socioeconomic impacts. Comparisons were made for coal-fueled plants with and without SO_2 scrubbers at certain locations. Six nuclear plant sites in Washington and Oregon were used as a basis of comparison with ten coal-fueled plant sites in Washington, Oregon and Wyoming, and nine reference coal deposits in Washington, Alaska, Wyoming, Montana, British Columbia and Alberta involving 22 coal plant and siting supply options (Ref. 61). Complexities in the nuclear fuel option included three options for plant decommissioning and various uranium supply options

including a sharp trend reversal of uranium yellowcake prices around the year 2000 because of the need to mine lower grade ores (Ref. 62). Various rates of price escalation are employed regarding the nuclear fuel option.

It is noted that the various States or Canadian Provinces which could be involved in the plant site and/or fuel supply options did not participate in this regional study. Nevertheless, making publicly available an internal planning study of this broad scope can serve to improve or delimit the problems of cooperative effort between State governments if WPPSS should decide to locate generating plants outside of the State of Washingtin which is presently permissible within its legal franchise. Other utilities in the United States sometimes construct facilities or serve markets in States other than their home State or, in the case of holding companies such as Middle South Utilities, perform integrated facility planning and market demand studies for a number of States. Thus, there is a need for greater interstate cooperation in achieving a more effective planning/licensing review process involving electrical facility construction and operation based on regional resources and energy demand analysis.

PART III

FEDERAL INITIATIVES TO IMPROVE FEDERAL-STATE COOPERATION IN NUCLEAR POWER PLANT LICENSING

1. ACTIVITIES OF THE NRC OFFICE OF STATE PROGRAMS

The Office of State Programs (OSP) of the Nuclear Regulatory Commission has engaged in numerous activities directed toward improving Federal-State cooperation in the licensing of nuclear power plants and dealing with related fuel cycle issues. Many of these activities have drawn upon the technical expertise of other NRC divisions as well as the OSP staff in its lead role. One primary objective of these activities is to facilitate an exchange of information on methodologies, procedures, guides, standards and factual data on safety and environmental issues associated with nuclear power plant licensing and other areas of NRC responsibility in which the States have an interest or shared responsibility.

Useful forums for the exchange of such information have been arranged by the OSP through workshops and conferences. Two Federal-State conferences were sponsored by the OSP on Power Plant Siting in which experts and administrators from various State and Federal agencies were brought together for an exchange of information, ideas and concepts. Proceedings of these conferences have been issued to reach a wider audience (Refs. 63, 64).

A number of special study efforts were initiated by the OSP following the directive of the Nuclear Regulatory Commission in September 1976 to examine the matter of regulatory activity in environmental decisionmaking regarding nuclear power plants and to suggest steps that could be implemented to improve this aspect of the licensing process. The following reports relate to this OSP program:

- Improving Regulatory Effectiveness in Federal/State Siting Actions, NUREG-0195 (Ref. 3).
- Success Factor Evaluation Panel, NUREG-0196 (Ref. 65).
- State Regulatory Activity Involved in Need for Power, NUREG-0197 (Ref. 66).
- State Perspectives on Energy Facility Siting, NUREG-0198 (Ref. 67).
- Environmental Planning and the Siting of Nuclear Facilities: The Integration of Water, Air, Coastal, and Comprehensive Planning into the Nuclear Siting Process, NUREG-0199 (Ref. 68).
- Federal/State Regulatory Permitting Actions in Selected Nuclear Power Station Licensing Cases, NUREG-0200 (Ref. 69).

- Water Supplies and the Nuclear Licensing Process, NUREG-0201 (Ref. 70).

- Nuclear Power Plant Licensing: A New England Perspective, NUREG-0202 (Ref. 71).

- State and Local Planning Procedures Dealing with Social and Economic Impacts from Nuclear Power Plants, NUREG-0203 (Ref. 72).

- Alternative Financing Methods, NUREG-0204 (Ref. 73).

- Need for Power: Determinants in the State Decisionmaking Processes, NUREG/CR-0022 (Ref. 74).

The manner by which these studies were prepared reflects in itself a notable spirit of Federal-State cooperation in improving regulatory effectiveness in Federal-State nuclear power plant licensing actions. Two examples are meaningful in this regard. The plan of execution in the preparation of the Preliminary Staff Report on Improving Regulatory Effectiveness in Federal/State Siting Actions involved in the following procedures (Ref. 3):

(1) Early arrangements to work with the staff and committees of the National Governor's Conference including two workshops under their auspices (Atlanta and Chicago) to develop an exchange of views on the study's objectives and potential proposals.

(2) Exchanges of views through direct contacts and correspondence with the Governors and various regulatory offices.

(3) A review of the purpose and scope of the program by representatives of other Federal agencies at two meetings organized by the Council on Environmental Quality.

(4) The organization within NRC of a Study Task Force to relate NRC experience to study objectives and receive comments on possible alternatives.

(5) The organization of two important panels of national experts to focus on two specific areas: (a) need for power or facility, and (b) the definition of criteria for effectiveness in regulatory activity.

(6) Contracts with five individuals and groups to assist in study areas where additional professional support was needed on special subjects such as funding regulatory activity, legal review of statutes involving planning and matters of regional organization.

Regarding the study report on Water Supplies and the Nuclear Licensing Process, the procedural steps were far simpler with limited involvement of the NRC staff (Ref. 70). The report was prepared for transmittal to the NRC under contract with the U.S. Water Resources Council, which in turn assigned the study effort to the Interstate Conference on Water Problems (ICWP). The ICWP Executive Committee serves as the Standing State Advisory Committee to the U.S. Water Resources Council and manages the activities of the ICWP. The

ICWP is a national association of State, intrastate and interstate officials and legislators whose purpose is to facilitate cooperation, consultation and exchange of information on the conservation, use, development and administration of water and related land resources, legal aspects, and Federal-State relationships in the field of water and related resources and to promote a harmonization of State and intrastate views on these matters. Although 24 States and two interstate agencies participated in developing the report through attendance at formal meetings and review of drafts, no endorsement by any State or Federal agency of the report's findings and conclusions was sought or is claimed. To provide a spectrum of variations in State and interstate procedures for licensing or control of water uses by energy facilities, nine appendices were provided in the report by the following States: Georgia, North Carolina, Wyoming, Montana, Washington, Minnesota, Pennsylvania, South Carolina, and the Delaware River Basin Commission (Ref. 70).

The NRC Office of State Programs has also initiated a number of studies and workshops with State agency participation involving a variety of safety-related issues. A number of States are involved in legal actions or have expressed serious concerns over the lack of facilities for the permanent and safe disposal of high level nuclear wastes. The U.S. Energy Research and Development Administration (ERDA), now the Department of Energy, has been authorized by the Congress to develop repositories for commercial high level wastes. Its schedule calls for an operational facility by 1985. The U.S. Nuclear Regulatory Commission has licensing and regulatory authority over the repositories, including the authority to set siting criteria which the repositories will be required to meet.

The NRC Waste Management Program and the Office of State Programs held three regional workshops to solicit ideas from State executives and legislators on the siting and licensing procedures for high level waste repositories and to solicit comment on the NRC preliminary site suitability criteria. The workshops were attended by 170 invited State executives and legislators from 46 States. In addition, there were over 80 observers from diverse backgrounds including the general public, government, industry, professional consultants and university faculty. Discussion group reports and the analysis and recommendations of the workshops have been published (Refs. 75, 76).

Another important problem involving Federal-State coordination is that of emergency response and evacuation planning. In March 1977, the NRC Office of State Programs had issued a report on "Standards and Procedures for Concurrence in State and Local Government Radiological Emergency Response Plans" (Ref. 77). In January 1979, the OSP issued a handbook entitled: "Radiological Emergency Response Planning: Handbook for Federal Assistance to State and Local Government" (Ref. 78).

Following the onset of the accident at the Three Mile Island (TMI) Nuclear Plant on March 28, 1979, public and governmental concern became heightened over the adequacy of emergency response and evacuation planning and governmental coordination of related activities. In October 1979, NRC's Office of State Programs issued a staff report, "Beyond Defense-in-Depth: Cost and Funding of State and Local Government Radiological Emergency Response Plans and Preparedness in Support of Commercial Nuclear Power Stations" (Ref. 79). This report describes as "inadequate, sporadic,

uncertain and frustrating" the current hodgepodge funding approach to State and local government radiological emergency response plans. The report proposes a funding scheme to be administered by the NRC and public comment was invited in the Federal Register (Vol. 44, No. 218, Nov. 8, 1979).

Still another safety-related issue involving Federal-State cooperation is that of nuclear power plant decommissioning policy. In March 1978, a report was published on a "Plan for Reevaluation of NRC Policy on Decommissioning of Nuclear Facilities" (Ref. 80). The Office of State Programs and the Office of Standards Development sponsored three regional workshops during September 18-30, 1978 in order to receive comments from State representatives and published the Conference Proceedings (Ref. 81). Following the publication of Revision 1 to NRC's March 1978 plan, two regional State workshops to be held in September 1979 were announced in the Federal Register (Vol. 44, No. 150, Aug. 2, 1979). The purpose of the workshops is to discuss the modified plan and the progress made during the past year. This will include additional technical information consisting of an expanded report on the decommissioning of pressurized water reactors and reports on the decommissioning of boiling water reactors and low level waste burial facilities. Comments will be sought on preliminary staff reports on financial assurance and residual activity limits.

2. NRC-STATE AGREEMENTS ON LICENSING PROCEDURES OR COOPERATIVE REVIEW EFFORTS

There are numerous examples of cooperative NRC-State efforts regarding safety and environmental aspects of nuclear power plant licensing and related activities in the mining, milling, transport and storage of nuclear fuels and wastes or emergency evacuation planning in the event of accidental radioactive releases. The NRC has entered into formal agreements with certain qualifying States regarding procedures for safety and environmental protection in the mining and milling of uranium. Moreover, prior to the formation of the NRC, the States of South Carolina and Louisiana, for example, entered into contractual agreements with the AEC and the Department of Transportation to provide studies of existing flows of radioactive materials in their respective States and to provide recommendations to make desirable improvements in the transport and storage of nuclear materials (Refs. 82, 83).

A different kind of example of NRC-State cooperation designed to improve the effectiveness of nuclear power plant licensing is the agreement recently consummated between the Virginia State Water Control Board and the NRC on requirements pursuant to the Federal Water Pollution Control Act Amendments of 1972 (FWPCA) (Ref. 84). Specifically, the cooperative efforts will extend to requirements for the control and consideration of impacts on water quality and aquatic biota associated with the licensing and regulation, including early site approval, of nuclear power plants located within the Commonwealth in accordance with principles embodied in the Second Memorandum of Understanding between the U.S. Nuclear Regulatory Commission and the Environmental Protection Agency. A brief summary of the points of the NRC-Virginia agreement include:

(1) Cooperation in the compilation of environmental information needed for early evaluations on water quality and aquatic biota in meeting the joint information needs of NRC licensing and the State issuance of water quality certifications pursuant to Section 402 of the FWPCA and the State Water Control Law, including, where applicable, Section 316(a) and Section 316(b) considerations.

(2) An early meeting of Virginia and NRC prior to or during the environmental licensing review process to discuss potential water quality and aquatic impacts.

(3) As early as practicable, to make investigation and evaluation of these matters to issue a timely permit pursuant to the State Water Control Law and Section 402 of the FWPCA as well as Section 401.

(4) Maintain close communications throughout the licensing review process including a status meeting to assess any significant new considerations that may develop.

(5) Conduct combined or concurrent hearings, where feasible, on the Board's Section 402 permits and NRC's construction permits, or other actions.

(6) Explore means by which joint or cooperative preparation of parts of Environmental Impact Statements for nuclear power plants could be accomplished with NRC assistance to the Board in the form of appropriate information and technical support.

Three other States have entered into similar agreements with the NRC to coordinate review activities related to the water quality requirements of the FWPCA Amendments of 1972: Indiana, Nebraska and South Carolina.

Another area in which it is desirable that NRC and affected States work in closer cooperation is the issue of "need for power"--or more appropriately, "need for baseload facility," since generating cost advantages and improved fuel mix in the applicant's system may, in some instances, provide sufficient reasons for adding baseload capacity even in the face of reduced rates of growth in electricity demands. The "need" issue, of course, is relevant to NEPA requirements since one alternative to the proposed construction of a baseload plant is not to build it at all, or at a later time than proposed. Despite the frequency and controversy of the "need" issue at NRC environmental hearings over the past four years, if past experience is a reliable guide, it would appear unlikely that NRC's evaluation of need will differ from the applicant's determination by more than several years, and the Atomic Safety and Licensing Boards of NRC, which make initial decisions on these matters (subject to appeal). have found that forecast differences of need by several years would be insufficient grounds for denial of a construction permit. Moreover, no such initial decision has yet been reversed.

Malcolm Ernst, NRC's Assistant Director of Environmental Technology, makes the following observations, outlining certain procedures and principles for

increased informational and analytical inputs by States in evaluating the "need" issue (Ref. 85):

> The NRC believes that cooperative efforts with States in this area would be useful, in that this could reduce the amount of duplicative review done by State and Federal governments. As a result, the NRC is in various stages of discussion with a number of States to see what kind of cooperative agreements can usefully be worked out.
>
> The principle behind these efforts is that, while the NRC cannot abdicate its NEPA responsibilities by delegating them to the States or by relying upon State analyses, the NRC can utilize State data and analyses in the NRC's decisional process. Several types of cooperative efforts are possible:
>
> (1) Establish common data needs.
>
> (2) Establish common analytical methodology.
>
> (3) Utilize State data and analyses as an adjunct to NRC's analyses.
>
> (4) Utilize State data, analyses and expertise directly in NRC's EIS and hearing process.
>
> All of the above stop short of accepting a State decision regarding "need" as being dispositive in the NRC decisional process. Even in the fourth case, the NRC would be familiar with the State's methodology and would be prepared to testify that the NRC's methodology is similar and would likely have yielded a similar answer. However, in the fourth case, the NRC reviewer would not testify regarding the specific analysis performed by the State--that would be the responsibility of the State's representative.

Of special interest in view of the variable and unsettled nature of forecasting methodologies as described above for different State experiences are certain procedural features and criteria which have been proposed for NRC-State agreement. It is suggested that portions of environmental impact statements and associated environmental evaluations on need-for-baseload facility additions would involve analysis of:

- Need-for-power, including likely positive or negative errors in forecasting electricity demand.
- Net economic benefits through retiring or replacing on reserve status existing units with high operating cost.
- Advantages of system fuel diversification.
- Cost-benefit comparisons of starting construction of a nuclear power plant earlier than actually needed compared to later than actually needed due to forecasting error.

Such evaluations and input to NRC's environmental impact statements will be prepared under guidelines and criteria mutually acceptable to a cooperating

State and NRC in order to assure that the needs of both are met, and will be subject to review and modification by NRC as necessary to meet its full NEPA responsibilities. Specific guidelines have been proposed:*

> The need for adding baseload (nuclear) generating capacity to an applicant's system can be justified in the public interest if the following criteria applied in combination (or possibly singly) are persuasive:
>
> (a) A need-for-power analysis that determines the adequacy of base-load generating capacity which would encompass (i) all proposed additions or deletions of generating facilities for several years beyond the planned inservice date of the proposed plant; (ii) forecasts of electrical energy demand for the general service area of the utility as well as the interconnected power pool which may serve as a market for export sales of baseload energy as well as a source of baseload energy purchases; and (iii) the contribution of baseload capacity to total capacity needs for meeting reliability or reserve margin requirements in view of changing trend relationships between baseload, intermediate and peaking needs as reflected in system load duration curves or production simulation models.
>
> (b) An analysis of the net economic benefits of proposed or potential actions for placing higher cost units on reserve or in retirement, especially those units whose high operating costs have resulted from a sharp escalation of fuel prices.
>
> (c) A judgmental evaluation of public interests of national and regional importance stemming from an improved mix of fuel for the applicant's system so as to reduce vulnerability to unexpected interruptions of a given fuel type (such as imported oil) or risk of a dramatic rise in prices for any fuel of substantial use in the applicant's system.
>
> (d) No specific forecasting technique (econometric or judgmental) will be required, but the methodology selected shall fall within the range of acceptable professional practices.
>
> (e) No forecasting methodology will be deemed acceptable unless it includes a reasoned consideration of the following causal factors which potentially might have a significant impact on future electricity demand growth in the service area or power pool region (to be evaluated whether the impact is deemed significant or not):
>
> (i) growth in regional population, number of households or residential customers, commercial and industrial activity (especially large firms that are heavy users of electricity);

*Harold R. Denton, U.S. Nuclear Regulatory Commission, personal communication to Lawrence A. Gollomp of the State of New York Public Service Commission, March 28, 1977.

(ii) a sensitivity analysis of the impact of high and low assumptions of rising real prices of electricity, but not necessarily a specific form of rate restructuring;

(iii) the collective impact of voluntary and government-induced nonprice conservation measures that are reasonably foreseeable to occur within the forecast period of relevance to the immediate investment decision;

(iv) regional saturation and baseload implications in the use of electricity in both summer and winter space-conditioning and for other applicances using substantial electricity;

(v) the relationship of fuel substitution in the region such as the use of heat pumps or solar energy in space heating and cooling, the growth of all-electric systems in new building construction, industrial conversion from gas to electric furnaces, etc., including the stimulus of alternative scenario assumptions on relative price movements and fuel interruption uncertainties for the key fuel options;

(vi) a discussion of the outlook for technological advances improving the efficiencies of electrical consumption or in developing new uses for electricity of importance to the regional analysis within the forecast period of relevance.

(f) Forecasts of electrical demand should be provided separately for the major customer classes: residential, industrial and commercial.

(g) In ascertaining need for power, the unreliabilities inherent in forecasting methodologies would not require a precise year of need, or scheduled inservice date, but rather a "window of launch" of perhaps several years would suffice corresponding to a range of high and low forecasts of demand growth for baseload capacity additions with feasible interconnection. An analysis of the likely positive or negative errors in forecasting that could reasonably be expected for the region served by the applicant's system, as well as the likely asymmetry of cost penalties of starting construction of a nuclear plant earlier than actually needed compared to later than actually needed, should be developed as the basis for determining an appropriate window of launch.

(h) Further detailed guidance on form and content is provided in NRC's Draft Environmental Standard Review Plan. Any substantive revisions of this draft will be subject to discussion by the parties of this Agreement with the objective of resolving any differences of viewpoints regarding input requirements to NRC environmental statements in need for baseload facility analysis.

The flexibility permitted above regarding the specific form of forecasting methodology (as distinguished from substantive elements to be included in whatever methodology is selected) is an important feature that would make practicable its application to a number of State forecasting procedures. For example, discussions held between the technical staffs of the State of New York and the NRC on forecasting methodologies and review procedures as related to need-for-facility analysis revealed a high degree of parallelisms which would indicate a need for relatively modest changes in the above proposed guidelines and criteria in order to reach agreement on specific wording.

Several States (New York, Indiana and Washington) have entered into agreements with the NRC regarding principles of cooperation in the regulation of nuclear activities covering a broad range of review and hearing activities. An example is the "Memorandum of Agreement between the State of Washington and the U.S. Nuclear Regulatory Commission," dated September 6, 1978, which provides for the following Principles of Cooperation:

1. Toward these goals, the State and NRC agree to explore together the development of detailed subagreements in areas of mutual concern, including, but not necessarily limited to, environmental reviews (or portions thereof) of nuclear facilities subject to licensing by NRC or certification by the State Energy Facility Site Evaluation Council (EFSEC); siting considerations; conduct and structure/format of hearings; confirmatory radiological environmental monitoring around operating nuclear facilities; decommissioning of nuclear facilities; emergency preparedness planning; response to radiological incidents; and radioactive material transportation monitoring.

2. Subagreements under this Memorandum may provide for activities to be performed by the NRC or the State under mutually acceptable guidelines and criteria which assure that the needs of both are met.

3. For activities performed by the NRC or the State at the request of NRC or the State under specific subagreements to this Memorandum, the agency making the request will explore means by which compensation may be made available to the other agency or by which the costs may be shared.

4. NRC agrees to explore with the State the possibility of sharing of proprietary information in NRC's possession with the State.

5. Each agency will explore means by which its training programs may be made available to the other.

6. Nothing in this Memorandum is intended to restrict or extend the statutory authority of either NRC or the State or to affect or vary the terms of the present agreement between the State and NRC under section 274b of the Atomic Energy Act of 1954, as amended.

7. The principal NRC contact under this Memorandum shall be the Director of the Office of State Programs. The principal State contact shall be the Chairman of the Energy Facility Site Evaluation Council (EFSEC). Subagreements will name appropriate individuals, agencies or offices as contacts.

8. This Memorandum shall take effect immediately upon signing by the State and the Nuclear Regulatory Commission, and may be terminated upon 30 days written notice by either party.

A pioneering agreement was signed on April 6, 1979, by the NRC and New York State (Ref. 86). This agreement between the New York Departments of Public Service (DPS) and Environmental Conservation (DEC) and the United States Nuclear Regulatory Commission (NRC) sets forth mutually acceptable levels of cooperation between the State of New York and NRC related to providing NRC with specific technical support of the DPS staff in preparation of designated sections of the NRC's Draft Environmental Statement (DES) and Final Environmental Statement (FES) for New Haven Nuclear Station, Unit Nos. 1 and 2.

It is the intent of this agreement that the technical staff of the DPS will provide services involving analysis, evaluation and written material in pre-selected subject areas, utilizing the NRC's Environmental Standard Review Plans. This cooperative endeavor is intended to reduce duplication, provide for more effective use of resources and permit a more orderly and efficient hearing.

The eighteen-point agreement is both comprehensive and detailed. The staff of the DPS will provide to the NRC information for inclusion in the DES and FES which shall primarily consist of technical review assistance in the subject area of need for power, hydrology, land use, demography, ecology (aquatic and terrestrial), socio-economics, plant and transmission facility description (to include non-radiological waste systems), non-radiological monitoring programs, impacts from construction and operation, environmental noise, alternative plant and transmission systems.

The staffs of NRC and the State of New York developed a "Protocol for the Conduct of Joint Hearings before the United States Nuclear Regulatory Commission and the New York State Board on Electrical Generating Siting and the Environment: New Haven 1 and 2" which was proposed for consideration by both parties on April 27, 1979.* One of the key provisions of the protocol involves the conduct of the evidentiary hearing. It was proposed that the evidentiary hearing shall proceed on a contention/issue basis--either a designated contention (NRC) or a contested issue (Article VIII). After an adequate period for full discovery of the applicants' direct case on a contention/issue, proper parties shall file their direct cases on that contention/issue. Thus, both parties (NY State

*Michael Flynn (NY Dept. of Public Service), David A. Engel (NY Dept. of Environmental Conservation) and Stephen H. Lewis (U.S. NRC), letter to members of the New York Public Service Commission and Department of Environmental Conservation, April 27, 1979.

and NRC) would establish staff positions on alternatives and related issues before the start of the evidentiary hearing. At previous hearings on proposed nuclear power plants in New York State, there was a divergency of practice in this regard since the NRC Staff took conclusive positions before the start of hearings whereas the staffs of the involved New York departments did not take affirmative positions on issues throughout the conduct of the hearings.

However, another divergency of analytic procedure remains unresolved. Whereas Article VIII requires that the proposed site and at least one alternative site be examined with equal detail regarding beneficial and adverse environmental impacts, the practice of the NRC is to examine only the proposed site at a high level of detail with analysis of alternative sites made on the basis of reconnaissance level information (Ref. 87).

Although a detailed schedule was agreed upon for the cooperative-staff reviews and joint hearing conduct regarding the New Haven 1 and 2 Nuclear Station, further staff activity has been suspended pending the outcome of an appeal to the New York State Siting Board.

3. GENERIC STUDIES, METHODOLOGICAL PROCEDURES, AND CONFIRMATORY RESEARCH EFFORTS OF THE NRC

If the NRC licensing review process would be strengthened and wasteful duplication of effort would be avoided by increased information and analytical inputs in selected areas from the technical staffs of various States, it would also appear that information and analyses produced by the NRC staff and their research contractors would be of potential benefit to a number of States in the exercise of their licensing reviews and permitting functions regarding proposed nuclear plants and sites. Such a two-way flow of information has already been practiced to some degree through individual or agency contacts and formally organized workshops.

However, much of this exchange of information has been opportunistic or based on happenstance of contacts rather than the result of systematic efforts or formalized agreements for the exchange of information. One of the problems is that converting such coordinative efforts from a largely passive or reactive mode to a more active or initiating mode involves the allocation of increased financial and manpower resources within NRC and other governmental agencies. This, of course, would require resolution through budgetary procedures or possibly an administrative reallocation of priorities involving resource assignments.

Tables 3-5 show various research studies (completed, in progress, or planned) initiated by the NRC Cost-Benefit Analysis Branch and the Environmental Specialists Branch. All of these studies are of generic significance to the improvement of environmental reviews in the nuclear power plant licensing process even though some are oriented to specific cases. Since many socioeconomic, water quality and ecological impacts are site-specific and plant/design-specific (especially cooling system

TABLE 3

Confirmatory and Generic
Research Program Related to Socioeconomic Impact Assessment

I. Completed Contract Studies:

"Development of Methodologies and Analytical Procedures to Quantify the Impact of Nuclear Power Plant Construction and Operation on Local Communities" (Turkey Point)

"Assessment of the Impact of Nuclear Power Plant Construction and Operation on Small Regions" (Robinson) (Ref. 89)

"A Post Licensing Case Study of Community Effects at Two Operating Nuclear Power Plants" (Pilgrim and Millstone) (ORNL/NUREG/TM-22) (Ref. 23).

"Socioeconomic Impacts: Nuclear Power Station Siting" (A Literature Review) (NUREG-0150) (Ref. 24).

"Effects of Nuclear Power Plants on Community Growth and Residential Property Values" (NUREG/CR-0454) (Ref. 90)

"A Post Licensing Case Study of Community Effects at Two Operating Nuclear Power Plants (Hatch & Brunswick) (NUREG/CR-0916) (Ref. 91)

"Post Licensing Community Impact from Trojan Nuclear Power Plant" (NUREG/CR-0973) (Ref. 26)

"Impact of Offshore Nuclear Generating Stations on Recreational Behavior at Adjacent Coastal Sites" (NUREG-0394) (Ref. 92)

"Study of the Visual Change Within a Region Due to Alternative Closed Cycle Cooling Systems and Associated Socioeconomic Impacts" (NUREG/CR-0975, 0977, 0989; there are three additional vols. which have not yet been assigned numbers)

"Three Mile Island Telephone Survey" (NUREG/CR-1093) (Ref. 93)

"The Social and Economic Effects of the Accident at Three Mile Island - Findings to Date" (NUREG/CR-1215) (Ref. 94)

II. Studies in Progress:

"Nuclear Power Station Construction: Labor Force Migration and Residential Choice"

"Small Region Forecasts of Population and Economic Activity" - Technical Assistance From U.S. Department of Commerce

"Construction Labor Force Estimates" - Technical Assistance from U.S. Department of Labor

"Twelve Post-Licensing Studies of the Socioeconomic Impacts of Nuclear Power Plant Siting"

"Socioeconomic Consequences of TMI Accident"

"Effect of TMI on Real Estate Markets"

III. Planned Studies:

"Land Use and Demographic Changes in the Vicinity of Nuclear Power Plants"

Source: Cost-Benefit Analysis Branch, Division of Site Safety and Environmental Analysis, Nuclear Reactor Regulation, NRC.

TABLE 4

Confirmatory and Generic Research Program Related to Technology Assessment and Need-for-Facility Forecasting

I. Completed Contract Studies:

"Commercial Electric Power Cost Studies" (An 8-volume study on the generic capital cost and total generating cost for coal and nuclear power plants) (NUREG-0241 through -0248) (Ref. 95)

"The Environmental Effects of Using Coal for Generating Electricity" (NUREG-0252) (Ref. 97)

"Regional Econometric Model for Forecasting Electricity Demand by Sector and by State" (NUREG/CR-0250) (Ref. 156)

"Econometric Model for the Disaggregation of State-Level Electricity Demand Forecasts to the Service Area" (NUREG/CR-1147) (Ref. 157)

"An Econometric Study of Electricity Demand by Manufacturing Industries" (NUREG/CR-1135) (Ref. 158)

"Estimation, Forecasting and Multiplier Simulation Analyses of Industrial Demand for Electricity in the United States" (ORNL, H. S. Chang and W. S. Chern) (In Draft)

II. Studies in Progress:

"Improvement of ORNL CONCEPT Computer Code and Updated Data Inputs for the Estimation of Plant Capital Costs and Operation and Maintenance Cost"

"Community, Regional, Health, and Environmental Impacts of the Coal Fuel Cycle"

"Sensitivity of Generation Cost with Changes in Electricity Growth Rates and Issuance of Construction Permits for Nuclear Power Plants" (NUREG-0634) (Ref. 96)

"Peak Electricity Demand Prediction Using Hourly Variation" (ORNL, J. L. Trimble et al) (In Draft)

"Generic Review of Conservation, Load Management, Rate Restructure, and Cogeneration" (ORNL, R. C. Tepel et al) (In Draft)

"Varying Elasticity Demand Model" (ORNL, W. S. Chern)

"Ex Post Forecasting Results and Utility Forecasts" (ORNL, W. S. Chern)

"Forecasts of Peak Demand and Load Distribution" (ORNL, J. L. Trimble)

"Integrated Forecast System" (ORNL, W. S. Chern)

III. Planned Studies:

"Update of Generic Investment Cost Study for Nuclear and Coal Generating Plants"

Source: Cost-Benefit Analysis Branch, Division of Site Safety and Environmental Analysis, Nuclear Reactor Regulation, NRC.

TABLE 5

Confirmatory and Generic Research Program Related to Environmental Assessments

I. Completed Contract Studies:

"The Use of Reconnaissance Level Information for Environmental Assessment" (NUREG/CR-0990) (Ref. 98)

"Comparison of Simulation Models Used in Assessing the Affects of Power-Plant-Induced Mortality on Fish Populations" (NUREG/CR-0474) (Ref. 99)

"Fish Protection at Steam-Electric Power Plants: Alternative Screening Devices" (Published by Oak Ridge National Laboratory, Report No. ORNL/TM-6472) (Ref. 100)

"The Application of Fisheries Management Techniques to Assessing Impacts: Task I Report" (NUREG/CR-0572) (Ref. 101).

"Management of Transmission Line Rights of Way for Fish and Wildlife" (An interagency report being published by the Fish and Wildlife Service U.S. Department of Interior)

"The Application of Aerial Photography Using Infrared Imagery for Environmental Monitoring of Operating Nuclear Plants" (A report being printed by the U.S. Government Printing Office)

II. Studies in Progress:

"Biocide Discharges from Nuclear Power Plants into Receiving Waters"

"Simulation Models to Determine Impacts of Nuclear Power Facilities on Fisheries"

"Effects of Power Plant Operation on Marine Borers"

"Significance of Threadfin Shad Impingement at Nuclear Power plants in Southeastern Reservoirs"

"The Use of Energy Flow Analysis in Land Use Impacts of Alternative Cooling Systems for Nuclear Power Plants"

"Methods to Assess Impacts of Hudson River Striped Bass Populations"

"Methods to Assess Impacts on Hudson River White Perch Populations"

"Source of Condenser Entrainment Mortality on Aquatic Organisms"

"Kinetics of Chlorine - Ammonia Interaction in Sea Water"

"The Products, Pathways, Effects and Fates of Chlorination By-Products"

III. Planned Studies:

"Chemical Effluents in Surface Waters from Nuclear Power Plants"

"Value of Population Replacement and Habitat Enhancement to Compensate for Nuclear Power Plant Impacts on Fisheries"

"Environmental Impact Assessment Methods and Mitigation Measures to Reduce Risk to Aquatic and Terrestrial Biota"

"Applicability of Plankton Studies in Power Plant Monitoring Programs"

"Applicability of Aerial Photographic Techniques for Site Assessment Relative to Terrestrial Ecology"

"Environmental Monitoring Data Review"

Source: Environmental Specialists Branch, Division of Site Safety and Environmental Analysis, Nuclear Reactor Regulation, NRC.

alternatives), a spectrum of confirmatory case-related studies covering a variety of situations and circumstances will be needed to provide a comprehensive set of empirical data on impacts actually realized that will serve to improve the quality and defensibility of estimates or forecasts of these kinds of impacts in an adversarial type hearing. It should be noted that, in confirmatory impact assessments, it is no less important to ascertain which impacts on the human environment were insignificant as it is to determine the magnitude of significant impacts. This is so because the potentiality for public controversy covers a wide spectrum of impacts, many of which are subsequently determined to have been insignificant for specific sites or which can be reduced to acceptable levels through mitigative measures (Refs. 14, 88). States which are engaged in their own Environmental Impact Statement preparation or licensing review functions would undoubtedly find many of these confirmatory studies helpful to their own analyses as well as decisionmaking on further delineation of programs and policies to deal with environmental matters, including legislative actions.

The NRC requirement to perform a need-for-facility assessment has resulted in a major series of NRC-sponsored research efforts at the Oak Ridge National Laboratory (ORNL). The work efforts focus on State-level forecasts of electricity demand which offers high transfer potential to State Public Utility Commissions and State Energy Offices. To date, aspects of this research have been presented at regional meetings before public utility commissioners and other interested State participants, and an interchange has already occurred between ORNL modellers and several States including California, New York, New Jersey, Ohio, and Montana.

Major aspects of the research include the development of a State-Level Electricity Demand (SLED) forecasting model, an econometric model for disaggregating State forecasts to the electric utility service area level, forecasts of peak load demand and load duration curves, and the quantification of non-price induced conservation effects. Table 4 provides an indication of the tasks already completed and those still in progress. At the focus of this research effort is a regional econometric forecasting model which forecasts State-level electricity demand and electricity price through the year 2000. The model uses a system of simultaneous equations and contains submodels for the residential, commercial, and industrial sectors. Structural parameters were estimated using State-level data for 1955 through 1976. Explanatory variables incorporated in the model include population, number of customers by sector, real per capita income, the price of electricity and alternative energy sources, number of gas customers, and value added in the manufacturing sector. Assumptions on the future growth of fuel prices, which is a major determinant in the price of electricity, were varied to capture the uncertainty inherent in forecasting demand for electricity.

For those States with an interest in gaining more insight regarding NRC's safety reviews associated with the licensing process, there have been a sizeable number of generic safety studies as listed in the (NUREG) Accession Lists for U.S. Nuclear Regulatory Commission Publications. Several such studies of widespread interest are:

- Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants (known as the Rasmussen/MIT Study), WASH-1400 (NUREG-75/014), U.S. Nuclear Regulatory Commission, October 1975 (Ref. 102).

- Health Effects Attributable to Coal and Nuclear Fuel Cycle Alternatives, Draft, NUREG-0332, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, September 1977 (Ref. 103).

- Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle, NUREG-0116, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, March 1977 (Ref. 104).

- The Nuclear Regulatory Commission Low-Level Radioactive Waste Management Program, NUREG-0240, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, September 1977 (Ref. 105).

- Joint ERDA-NRC Task Force on Safeguards (U), Final Report (Unclassified Version), U.S. Nuclear Regulatory Commission and U.S. Energy Research and Development Administration, July 1976 (Ref. 106).

- A Study of the Nuclear Regulatory Commission Quality Assurance Program, NUREG-0321, prepared by Sandia Laboratories for the U.S. Nuclear Regulatory Commission, August 1977 (Ref. 107).

- "Transport of Radioactive Material in the U.S.: A Detailed Summary of Survey of Radioactive Material Shipment in the United States", NUREG-0073, prepared by the Battelle Northwest Laboratory for the Office of Standards Development, U.S. Nuclear Regulatory Commission, May 1976 (Ref. 108).

- Occupational Radiation Exposure at Light Water Cooled Power Reactors: 1969-1975, T. D. Murphy, et al., NUREG-0109, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, August 1976 (Ref. 109).

- Risk Assessment Review Group Report to the U.S. Nuclear Regulatory Commission, H. W. Lewis, Chairman, NUREG/CR-0400, September 1978 (Ref. 110).

- "NRC Statement on Risk Assessment and the Reactor Safety Study Report (WASH-1400) in Light of the Risk Assessment Review Group Report," a statement issued by the U.S. Nuclear Regulatory Commission on January 18, 1979 (Ref. 111).

- Final Liquid Pathway Generic Study Report, NUREG-0440, a comparative study of radiological impacts on man and biota of a postulated core-melt (Class 9) accident for floating nuclear plants versus land based plants, U.S. Nuclear Regulatory Commission, February 1978 (Ref. 112).

- Radiological Effluent Technical Specifications, NUREG-0472 for PWRs and NUREG-0473 for BWRs, U.S. Nuclear Regulatory Commission, July 1979 (Ref. 113).

- Activities, Effects, and Impacts of the Coal Fuel Cycle for a 1,000-MWe Electric Power Generating Plant, NUREG/CR-1060, a report prepared by Teknetron, Inc. for the U.S. Nuclear Regulatory Commission, February 1980 (Ref. 114).

A study of special significance for those States interested in siting policy with particular focus on safety-related issues is the Report of the Siting Policy Task Force (Ref. 115). Nine policy change recommendations were made by the Siting Policy Task Force to achieve the following goals (p. iii):

(1) To strengthen siting as a factor in defense in depth by establishing requirements for site approval that are independent of plant design consideration. The present policy of permitting plant design features to compensate for unfavorable site characteristics has resulted in improved designs but has tended to deemphasize site isolation.

(2) To take into consideration in siting the risk associated with accidents beyond the design basis (Class 9) by establishing population density and distribution criteria.

Plant design improvements have reduced the probability and consequences of design basis accidents, but there remains the residual risk from accidents not considered in the design basis. Although this risk cannot be completely reduced to zero, it can be significantly reduced by selective siting.

(3) To require that sites selected will minimize the risk from energy generation. The selected sites should be among the best available in the region where new generating capacity is needed. Siting requirements should be stringent enough to limit the residual risk of reactor operation but not so stringent as to eliminate the nuclear option from large regions of the country. This is because energy generation from any source has its associated risk, with risks from some energy sources being greater than that of the nuclear option.

As a result of the accident at the Three Mile Island Power Station, the President's appointed (Kemeny) Commission has made a number of recommendations to improve safety and emergency evacuation planning (Ref. 116). A preliminary analysis and views of the Nuclear Regulatory Commission regarding these and other recommendations was released on November 9,

1979 (Ref. 117). A number of other NRC studies related to the safety aspects of the Three Mile Island (TMI) accident are:

- TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations, NUREG-0578, July 1979 (Ref. 118).
- Title List: Publicly Available Documents, Three Mile Island Unit 2, NUREG-0568, Rev. 1, Cumulated to June 30, 1979 (Ref. 119).
- Investigation into the March 28, 1979 Three Mile Island Accident by Office of Inspection and Enforcement, NUREG-0600, August 1979 (Ref. 120).
- Evaluation of Long-Term Post-Accident Core Cooling of Three Mile Island Unit 2, NUREG-0557, May 1979 (Ref. 121).
- Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station, NUREG-0558, May 1979 (Ref. 122).
- Three Mile Island Telephone Survey: Preliminary Report on Procedures and Findings, NUREG/CR-1093, prepared by Mountain West Research, Inc. for the U.S. Nuclear Regulatory Commission, October 1979 (Ref. 93).
- The Social and Economic Effects of the Accident at Three Mile Island NUREG/CR-1215, prepared by Mountain West Research, Inc. with Social Impact Research, Inc. for the U.S. Nuclear Regulatory Commission, January 1980 (Ref. 94).

4. NRC INHOUSE EFFORTS TO IMPROVE THE LICENSING PROCESS

Those States which have expanded or are contemplating an expanded role in the nuclear licensing review process may find useful information in a number of studies or published materials that are designed to improve the effectiveness of NRC's licensing process or that provide a more indepth investigation of controversial issues than are normally provided in routine case reviews. The latter would include special staff treatment and more thorough development of methodologies regarding issues of unusual difficulty or complexity in certain Environmental Impact Statements or supplemental hearing testimonies. An example of a useful testimony is that prepared by Sidney Feld, Regional Environmental Economist in NRC's Cost-Benefit Analysis Branch, regarding intervenor Contention I-19 in reference to the proposed Wolf Creek Nuclear Generating Station (Ref. 123):

> The applicants' projections of demand, and thus the assessment of the need for the proposed WCGS, are inadequate and overstated because they fail to take into account price elasticity of demand for electricity. The real price of electricity per kilowatt hour will increase, and will result in a decrease in demand from that predicted by the applicants.

In his supplemental testimony, Dr. Feld provides an illuminating review of the diversity of expert opinion and some of the serious methodological difficulties in forecasting future electricity price elasticities which is a frequent and troublesome issue in need for power analysis in nuclear power licensing actions. Many other hearing testimonies would also provide valuable insight on methodological procedures of generic importance.

Regarding Environmental Impact Statements, there are also a large number of examples (not yet catalogued) that would lend useful insight for the treatment of special environmental and socioeconomic issues. One such example is the EIS for the Indian Point Unit No. 2 nuclear plant, which examined at greater than customary depth the internal and external (or indirect social) costs associated with various cooling system alternatives in compliance with the ASLB's decision to require backfitting of a closed-cycle cooling system to reduce adverse impacts on certain important fishery species of the presently operating open cycle (once-through) cooling system (Ref. 124). In support of the analysis of the aesthetic (and related water and land use) impacts of different types and heights of cooling towers, the NRC contracted for a special methodological study by Jones and Jones (Ref. 125), a landscape architecture and planning consulting firm.

Another useful example, which addresses the issue of risk perception and its possible impact on nearby tourism, is found in the socioeconomic impact treatment of the proposed floating nuclear power plant near Atlantic City as set forth in the Draft Environmental Statement for the Atlantic Generating Station (Ref. 126) and a supporting contract study by Baker et al (Ref. 92) on related impact assessment methodology. Bjornstad of the Regional and Urban Studies Section of the Oak Ridge National Laboratory has prepared a study of local tax benefits and related impact issues associated with paired case studies of the Millstone and Pilgrim nuclear power plants (Ref. 127). A more broadly based study of environmental impacts is found in a report by Richard Foster et al on "The Use of Reconnaissance Level Information for Environmental Assessment" (Ref. 98). This study classifies site characteristics according to three potential levels of concern for such impact issues as: (i) aquatic ecosystems, (ii) terrestrial ecosystems, (iii) land use, (iv) water use, (v) socio-economics, and (vi) institutional, or statutory, requirements such as the Endangered Species Act.

Regarding the possible interest of States in impacts associated with nuclear energy centers, a special projects study by the NRC commands attention. The Energy Reorganization Act of 1974, which established the NRC as an independent agency, mandated in Section 207 the development of a report which would provide any appropriate conclusions and recommendations concerning the feasibility and practicality of locating nuclear power reactors and other elements of the nuclear fuel cycle on nuclear energy center sites including information on a survey of possible sites (Ref. 128). The study design features and issues to which attention was directed are described in the Executive Summary:

The Nuclear Energy Center Site Survey (NECSS) is a study of a potential alternative siting approach for nuclear power and fuel-cycle facilityes--an approach that would cluster sizeable groups of such facilities on a relatively small number of sites as contrasted with current "dispersed" siting practices. The largest aggregation of reactors on a single site being planned today is four, and this "quad" is assumed (for comparative study purposes) to be the typical "dispersed" site by the year 2000.

Three basic types of nuclear energy centers are considered:

- Power plant centers, consisting of 10 to 40 nuclear electric generating units of 1200 megawatt electric capacity each.
- Fuel-cycle centers, consisting of fuel reprocessing plants, mixed-oxide fuel fabrication facilities, and radioactive waste management facilities.
- Combined centers, containing both power plants and fuel-cycle facilities.

Concentrating on differences from dispersed siting approaches, the survey evaluates the feasibility and practicality of the nuclear energy center (NEC) concept.

The major technical feasibility issues include dissipation of waste heat from the energy center; transmission systems design, reliability, and economics; economics of energy center construction; and radiological and environmental impacts.

The major practicality issues include jurisdictional and institutional constraints; social, sociopolitical and socioeconomic factors; financing; questions related to accident risk, natural disasters, and national security; and safeguarding of strategic special nuclear materials from theft and nuclear plants from sabotage.

While feasibility evaluation is primarily a technical study, the practicality issues are people-oriented; they involve the various interests, perceptions and values of people and the characteristics of institutional instruments.

The survey also included a general screening effort directed towards identifying large land areas that would be likely to contain potentially suitable NEC sites. The screening was done for each of the nine electric reliability regions into which the area of the continuous United States is divided for coordinated planning of dependable electric power supply.

The screening was accomplished by use of selected coarse criteria involving water resources, seismicity, population distribution,

and public lands. Both refinement of criteria applied and the factoring-in of additional considerations would be needed to identify specific sites. This would require substantial expenditures of time and money, and could not have been accomplished under the NECSS.

Another report of potential value to States which would participate at greater depth in nuclear power plant licensing reviews is the GESMO study on "Generic Environmental Statement on the Use of Recycle Plutonium in Mixed-Oxide Fuel Light Water Cooled Reactors" (Ref. 129). The scope of safety, environmental and economic analysis of options regarding plutonium recycle found in this study provides far more useful information regarding short-range and long-range fuel cycle and (LWR) nuclear plant review considerations than its rather narrowly-defined title might suggest. The study was prepared to aid the Nuclear Regulatory Commission in the process of arriving at a decision as to whether or not the use of mixed-oxide fuel (a mixture of recycled plutonium oxide and uranium oxide) in light water reactors should be permitted on a widescale basis and, if so, under what conditions. Chapter 11 on "Economic Analysis and Cost-Benefit Balancing includes parametric studies on the influence of growth (through the year 2000) in electricity demand; effects on uranium price, the price of separative work, MOX fuel fabrication price, fuel disposal cost; effect of discount rate on decision to recycle; effect of the fast breeder reactor; and effect of uncertainties on fuel cycle costs.

In order to achieve the societal benefits of making the licensing process more stable and predictable and the cost advantages of reducing the overall time required to issue a construction permit and construct the nuclear power plant, the NRC has developed a number of initiatives resulting in studies or reports that would be useful to States in the exercise of their licensing or permitting responsibilities. These benefits, of course, are principally realized at the State level and particularly at the consumer level within the applicant's general service area. Hence, it would appear that States would have substantial interest in such initiatives, lending support and encouragement to facilitate the attainment of these objectives. A number of NRC efforts are noteworthy in this regard:

(1) Development of policy and the review of specific applications for standardized nuclear power plants (Refs. 130, 131).

(2) The formulation of acceptable procedures for early site review (Ref. 132).

(3) The development of safety and environmental Standard Review Plans which provide specific procedural instructions to the NRC staff responsible for conducting reviews for licensing applications in the construction and operation of nuclear power plants, including appropriate methodologies and review criteria where practicable and desirable (Refs. 133-135).

(4) The development or improvement of standards and technical specifications for plant operations which set effective limits on safety and environmental impacts pertaining to each reactor or plant design (Refs. 136-138).

(5) The development or improvement of regulatory guides which provide information on the kinds of information and analyses to be submitted by the applicant for a construction permit or operating license (Refs. 139-144).

A number of the above NRC initiatives are intended to provide other benefits or advantages in addition to their role in making the licensing process more uniform and predictable or to achieve the cost reductions in shortening the licensing and construction time. For example, early site reviews hold promise of earlier and more effective public participation in the licensing process. Standard Review Plans will reduce unproductive detailed information and analyses for less consequential impacts and focus more effectively on the more important safety and environmental issues, thus contributing to sounder and more defenisble licensing decisions including mitigative measures. The development or improvement of standards, technical specifications and regulatory guides will have similar benefits.

A staff report by an NRC study group (Ref. 2) made a number of recommendations involving opportunities for improving the licensing of nuclear power plants involving the refining of a number of the above measures plus additional initiatives deserving of staff effort:

(1) Improve the quality of applications by improving guidance and strengthening acceptance criteria.

(2) Improve the quality of applications by eliminating unnecessary information.

(3) Increase pretendering coordination with applicants.

(4) Expand and restructure the Acceptance Review.

(5) Modify the current review process by developing an Early Safety Evaluation Report based on the application as docketed.

(6) Increase public participation during staff review.

(7) Improve the hearing process.

(8) Study of long-range standardization policy.

(9) Modify LWA (Limited Work Authorization) rules.

(10) Increase use of rulemaking.

(11) Eliminate mandatory ACRS review.

Staff task forces and committees are being organized within NRC to explore more fully the opportunities for licensing improvement of most of the above recommendations. Generic issues, or issues that are frequently raised in hearings and whose treatment has become relatively routine, might suitably be dealt with through rulemaking. In response to a Commission directive, the staff prepared an interim statement of general policy and plans for rulemaking, which the Commission approved for publication in the Federal Register (December 14, 1978). This interim policy statement fully supports Executive Order 12044 of March 23, 1978, requesting improvement of existing and future government regulations so as to be as simple and clear as possible and avoid imposing unnecessary burdens on the economy, on individuals, on public and private organizations, or on State and local governments. The interim policy statement fully supports Executive Order 12044 of March 23, 1978, requesting improvement of existing and future government regulations so as to be as simple and clear as possible and avoid imposing unnecessary burdens on the economy, on individuals, on public and private organizations, or on State and local governments. The interim policy statement and supporting discussions are presented in an NRC report, Preliminary Statement on General Policy for Rulemaking to Improve Nuclear Power Plant Licensing (Ref. 145).

Ten candidate issues were identified by the staff for generic rulemaking: (1) future availability and price of uranium, (2) alternative energy sources to the nuclear option, (3) need for adding baseload generating capacity, (4) methodological and information requirements in the analysis of alternative sites, (5) criteria for the assessment of nuclear plant impacts and mitigative measures; (6) generic procedural criteria to define more concretely NRC responsibility in assessments and decisions regarding certain water-related impacts in relation to the statutory authorities of EPA and permitting states, (7) NEPA decision criteria for OL reviews, (8) occupational radiation exposure control, (9) generic radiological impact for normal lightwater reactor radionuclide releases, and (10) threshold limits for generic disposition of cooling tower effects. Criteria developed by the Steering Committee on Reactor Licensing Rulemaking to aid in identifying suitable candidate issues for rulemaking include thefollowing: the issue must be generic; there must be a likelihood of a useful, definitive rule; and there must be a likelihood of a stable rule. Value-impact criteria for appraising the desirability and priorities of specific proposals for generic rules include:

- Achievement of more effective public input and improved public understanding of NRC's analytical procedures and decision criteria in treating potential environmental and safety issues in the licensing process for nuclear power plants.

- Improvement of the stability and predictability of the licensing process, including the provision of orderly and clear procedures for State-Federal cooperation in treating generic licensing issues.

- Accomplishment of an overall savings of manpower and financial resources of the NRC, the public, the utility industry, and other local, State, and Federal agencies involved in the nuclear licensing process.

- The short-term increase in dollar costs of the various participants in the rulemaking action, including contractual support.

- The additional impacts (i.e., opportunity costs) of diverting manpower and other resources to the rulemaking process and away from other productive uses for a temporary period.

As noted above, one of the ten issues identified for possible general rulemaking was that of alternative site methodology and information requirements. In order to clarify this issue, the staff issued for comment simultaneously a report on December 14, 1978 entitled, General Considerations and Issues of Significance on the Evaluation of Alternative Sites for Nuclear Generating Stations under NEPA (Ref. 87). In addition to receiving public comments on the report, the staff conducted a three-day public workshop in March 1979 to actively seek comments and ideas on rulemaking for alternative sites. Representatives from industry, State and Federal government, public interest groups and others participated. Utilizing public comments and the results of the workshop, the staff drafted proposed amendments to 10 CFR Part 51 which pertain to the evaluation of alternative sites. These amendments were submitted to the Commission in July 1979 for their consideration.

There are a number of useful inhouse studies of generic significance prepared by the NRC staff which would be appropriate references for case-related analyses in the preparation of environmental impact statements. As a desirable method of reducing paper work in EIS preparation, the new CEQ regulations (Sec. 1502.21) encourage the incorporation by reference of materials relevant to impact analysis (Ref. 34). Moreover, the greater indepth treatment of analytical methodologies, citations of pertinent data and discussions of the complexities and uncertainties of impact causal factors and potential mitigative measures which are pursued in generic studies make for sounder, more defensible environmental decisions.

One such generic study is the NRC staff report on "Coal and Nuclear: A Comparison of the Cost of Generating Baseload Electricity by Region" (Ref. 146). The purpose of this study is to improve the basis for the staff's independent analysis of the comparative economic evaluations of alternative fuel choices as provided by an applicant for a nuclear construction permit. The study compares the economics of a 2400 MWe nuclear and coal electric generating station in 10 different regions of the United States. Delivered coal costs are the primary cause of regional generating cost variations; therefore, the regions were based on the Department of Energy's (DOE) regions for delivered coal costs. The capital cost for coal-fired generating units includes the cost of sulfur removal. The economics are based on a station beginning operation about 1990 for an investor-owned utility.

The study is based on data inputs from numerous sources, and it avoids the pitfalls of cost analyses based on national averages by highlighting regional differences which--in addition to the transportation costs of coal affecting the delivered cost of coal to different regions--include variations in coal characteristics, and construction costs for labor and materials, as well as labor productivity.

A companion report by the NRC staff is a generic study of the "Sensitivity of Generation Cost with Changes in Electricity Growth Rates and Issuance of Construction Permits for Nuclear Power Plants (Ref. 96). The study was done from the licensing point of view. In addition to meeting the NEPA "need for the facility" requirements, the study also provides a generic view of the impacts and costs incurred when it is necessary to deny or delay a construction permit for reasons other than "need for facility". The study identifies areas of the country and situations when economics are likely to be a significant factor in denying or delaying the issuance of a construction permit. An analysis is provided of the impacts on planning schedules and the sensitivity of generation cost with changes in forecasts of electricity demand and changes in issuance of construction permits. The report is based on a generic study of four scenarios for a large system that is representative of a very large utility or a regional reliability council and a small system large enough to accommodate a 1200 MWe nuclear unit either in a single utility system or in a cooperative arrangement involving several smaller utilities.

A preliminary estimate resulting from the Three Mile Island Telephone Survey (supra) is that about 144,000 persons temporarily moved out of the zone within 15 miles of the plant site, travelling an average distance of 100 miles to a total of 21 states. This, in itself, is an indication of the extent of psychological stress, although not its intensity or long-term duration. Staff studies are in progress which deal with the interrelated topics of psychic (or anxiety) costs, risk perception and risk aversion related to alternative sources of energy for generating electricity (Ref. 147). Other staff studies of generic value as related to risk assessment include:

(1) Demographic Statistics Pertaining to Nuclear Power Sites, NUREG-0348, December 1977 (Ref. 148).

(2) Aircraft Impact Risk Assessment Data Base for Assessment of Fixed Wing Air Carrier Impact in the Vicinity of Airports, NUREG-0533, June 1979 (Ref. 149).

5. IMPROVED LIAISON AND COORDINATION WITH OTHER FEDERAL AGENCIES WHOSE ACTIVITIES RELATE TO NUCLEAR LICENSING

In Figure 6 of Part I is shown a variety of activities of other Federal agencies which relate to nuclear power plant licensing. The NRC has already achieved a good measure of liaison and cooperation with such agencies in the performance of the licensing function. Copies of Draft Environmental Statements are routinely sent for review to potentially affected Federal, State and local agencies. For example, the DES for

the proposed Black Fox (nuclear) station was sent by the NRC to the following governmental agencies for review (Ref. 150):

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Energy Research and Development Administration
Environmental Protection Agency
Federal Power Commission
Federal Energy Administration
Office of the Governor of Oklahoma
Mayor of Inola

Because of the frequent interrelation of NRC licensing reviews of certain environmental and safety issues with areas of responsibility and expertise of the Environmental Protection Agency and the Army Corps of Engineers, Memoranda of Understanding have been entered into between NRC and these agencies. A description of this relationship on a case basis is found in the FES for the Black Fox station (Ref. 150, p. xiv):

> In response to Memoranda of Understanding (Refs. 151, 152) which govern certain interactions of the U.S. Nuclear Regulatory Commission with the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers, the staff has submitted to those agencies, and received comments thereon (Statements of Positions) which previewed interim staff conclusions and positions of environmental matters of mutual interest. The staff has considered these comments during the preparation of this Environmental Statement. While exclusive jurisdiction resides with the U.S. Environmental Protection Agency (EPA) to regulate nonradiological effluents (and it will do so via its NPDES permit when issued), the NRC is required to assess the environmental impact of permitted discharges. However, in order to ascertain the environmental consequences of power plant licensing, NRC is placing increasing reliance on EPA's permit system, a result of the National Pollution Discharge Elimination System (NPDES). A major step to avoid the confusion and inequity resulting from regulation of the aquatic environment by two Federal agencies was taken with the closely coordinated review of TVA's Yellow Creek Nuclear Station Construction Permit Application. As a consequence of the Yellow Creek Proceeding, which suggested that this approach was not only desirable but legally necessary, the NRC staff is striving to obtain EPA or State agency resolution of questions pertaining to water quality that may arise during NRC's environmental review.

Other relationships with other Federal agencies are generally established on an ad hoc case-by-case basis. For example, the licensing review of the generic statement for the Offshore Power System floating nuclear plant

concept and the proposed floating units of the Atlantic Generation Station offshore of New Jersey required very close liaison and frequent meetings with the U.S. Coast Guard. The emergence of any concerns over endangered species habitats which might be affected by a proposed nuclear plant would require close consultation with the cognizant office in the U.S. Department of Interior (Ref. 153). Likewise, any concern over historic impacts would require consultation with the Advisory Council on Historic Conservation which provides an updating service regarding a list of sites throughout the United States of historic and cultural value (Ref. 154).

Other consultations on technical data and related analyses are frequently made with cognizant Federal agencies regarding geology and seismology, hydrology, meteorology, ecology and the like. Since water supply problems are becoming more acute in various regions or water basins of the United States, increased liaison with cognizant State, regional or Federal agencies on these matters is assuming greater importance. The same is true for the developing State and regional programs under the Coastal Zone Management Act which provides for various kinds of Federal assistance to these programs including problems arising from large-scale energy developments in coastal areas (Ref. 155).

Additional detailed information on cooperation with other Federal agencies in the review of environmental and safety impacts involved in the licensing of nuclear power plants may be found in Chapter 3 of the 1979 Annual Report for the U.S. Nuclear Regulatory Commission. The past five years has witnessed a substantial growth in cooperation between Federal, State and local agencies in environmental impact analyses associated with nuclear power facilities. There is good reason to suppose this trend will continue; for the alternative to increased cooperation is wasteful duplication, delay, and loss of effectiveness in serving the public interest in reconciling the country's needs for increased domestic sources of energy while protecting or enhancing environmental values.

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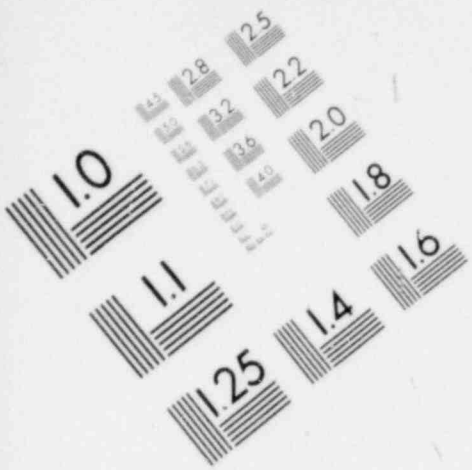

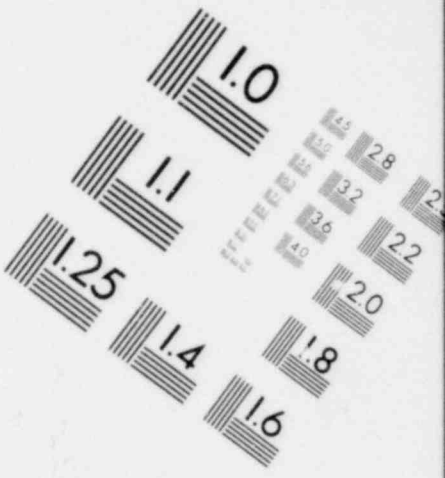

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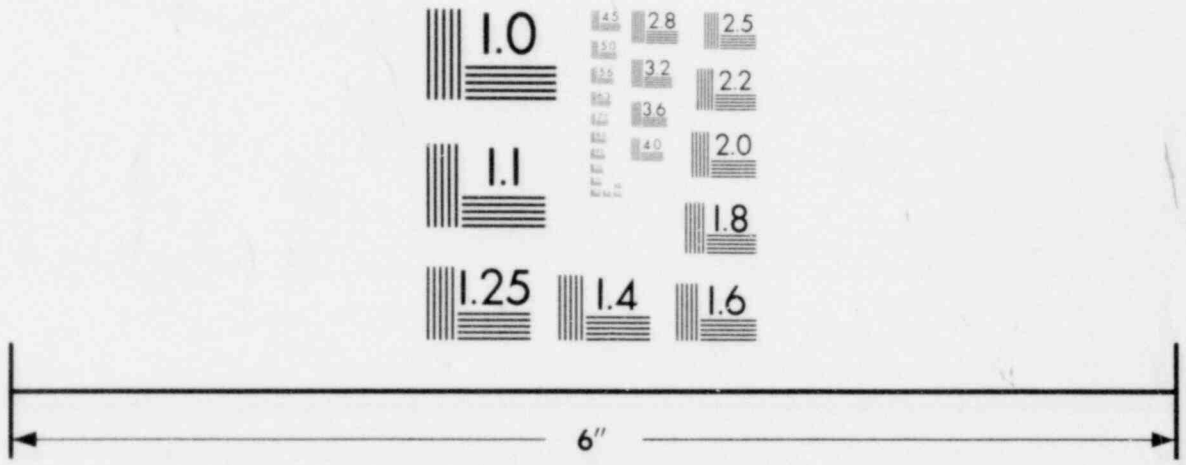

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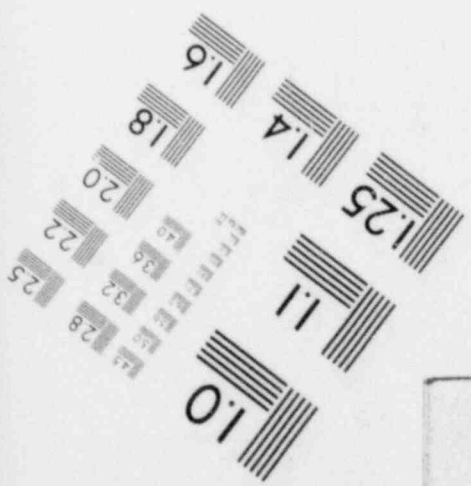

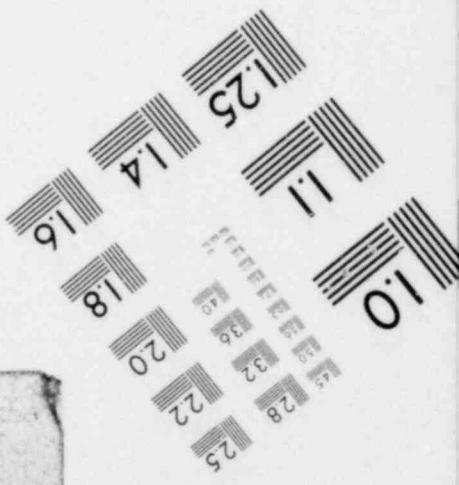

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A growing number of States are involved in environmental review in nuclear power plant licensing. The diversity of State siting laws and licensing procedures are sources of inefficiency in Federal-State cooperation. Improvements are needed to avoid wasteful duplication and licensing delays. This paper, presented at the Third Annual Meeting of the National Association of Environmental Professionals in February 1978, is updated and presented in three parts. Part I, A Review of Roles and Environmental Issues, discusses: (i) environmental issues and the related roles of the NRC, the utility applicant, and other State and Federal agencies; (ii) the basis of interest for State involvement in licensing activities; and (iii) the basis of interest for a continued Federal role. Part II, Diversity of State Practices in Nuclear Power Plant Licensing, provides a review of contrasting State practices in the licensing process, with special focus on issues such as need for facility and siting. Part III, Federal Initiatives to Improve Federal-State Cooperation in Nuclear Power Plant Licensing, describes initiatives by the NRC to improve licensing cooperation, formal agreements with States regarding licensing procedures, research studies on safety and environmental review methodologies, improved coordination with other Federal agencies, and generic rulemaking.

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