STATE OF RHODE ISLAND & PROVIDENCE PLANTATIONS

EXECUTIVE CHAMBER

PROVIDENCE

J. JOSEPH GARRAHY
GOVERNOR

August 3, 1979

Phillip C. Cota, Ph.D.
Environmental Projects
Branch 1
Division of Site Safety
and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D. C.

Dear Dr. Cota:

Enclosed are copies of our technical reviews of the Draft Environmental Statement on NEP 1 and 2.

These comments are to be considered provisional in nature. Should the NEP 1 and 2 application be reactivated, the State of Rhode Island will submit more extensive comments.

Yours truly,

Sean A. Kelleher, Ph.D.
Energy Capability & Management
Governor's Energy Office
80 Dean Street
Providence, RI 02903

Enclosures

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REVIEW OF SECTIONS
of
Draft Environmental Statement
dealing with
Hydrology

William E. Kelly
Wakefield, R.I.

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General Comments

Freshwater hydrology is not adequately described in the DES. The importance of freshwater inflow to the ponds is dismissed with a statement to the effect that it is small. However, no estimate of ground water or surface flow into the pond system is made and no estimate of the effect of the reduced ground water outflow to the pond system is attempted.

No attempt is made to estimate a water budget for the area other than references to the average annual rainfall. Average annual recharge is not a reliable indicator of sustained aquifer yield for this site. The proposed use of ground water at the site is significant and its impact cannot properly be evaluated without a water budget.

A slurry trench wall is proposed for dewatering and this will certainly lessen if not eliminate the possiblity of salt water intrusion and interference with offsite wells due to dewatering. However, the concept is presented in a generalized way so that it is difficult to assess its probable effectiveness. Secondary effects of the slurry trench wall are not considered at all. Recharge to the aquifer will be reduced and the impervious trench wall will increase drawdowns from ground water withdrawals during construction which are anticipated to be the largest withdrawals at the site.

Over the long term, the effect of development of ground water for plant use on ground water availability for the town of Charlestown is not considered. Although average usage of ground water at the proposed plant is less than .1 mgd this is a significant part of the estimated .6 mgd estimated available 1970 supply and the .15 mgd 2020 estimated surplus.

Specific Comments

2.3 -Sands Pond which is reportedly used for water supply on Block Island appears to be slightly closer to the site than Jamestown Pond.

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2.5.1.1 -No estimate of the freshwater input to the pond system is made. King Tom Pond and Cross Mill Pond are referenced in the text but not shown on Fig. 2.4. which is difficult to read.

2.5.2.1 -Which artesian well is mentioned? South Kingstown has two water table gravel packed wells at Factory Pond. There are no artesian public wells in the area.

-Reference is made to the Pettaquamscutt and Saugatucket Rivers which are misspelled. Flow is generally south; the statement on local modification by the rivers is either irrelevant or incomplete. For example, Fig. 6-3 shows ground water flow varying from a generally westerly direction near Foster Cove to nearly easterly along the east side of the site.

-If "ground water is recharged by precipitation" then there should be "a close connection between precipitation and increases in level".

-Couldn't a statement about the response of ground water levels to storm-induced flooding be made if the question is relevant? Salt water contamination of fresh ground water would certainly be one result of coastal flooding.

-Is the conclusion that ground water will be sufficient to supply Charlestown through the year 2020 based on ground water availability or maximum pumping capacities? How would construction of the proposed power plant effect ground water available to Charlestown?

2.5.2.2 -What is the significance of the bedrock aquifer for the proposed power plant? Couldn't some statements be made on the probable limits of its characteristics from data already available in the PSAR?

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3.3 -The 98,000 gpd withdrawal rate is an average figure. What are the peak pumping rates expected to be, what are their expected durations, and during what time of the year can they be expected to occur?

-Are the cooling tower basins separate from the ground water system? How and over what period could these basins be resupplied by ground water?

-What are the expected durations of the 200 gpm peaks expected during construction and preoperational testing? How will the 40 million gallons of freshwater required for preoperational testing be obtained? If from ground water, is this included in the 200 gpm peak estimate?

4.2.1.2 -How will the presence of the slurry wall effect ground water availability during and after construction?

4.2.2.1 -The analysis of the impact of dewatering in the absence of the slurry wall is apparently unpublished and was not readily available for this review.

4.2.2.2 -Are the impacts of both the reduction in quantity of the freshwater input to the ponds and the quality change to be considered?

4.2.3 -As part of the construction dewatering plan a numerical ground water model should be developed. This should be used to predict effects and for designing a monitoring system to assure limited offsite impacts. Monitoring on the site perimeter would <u>not</u> be adequate to insure that chlorides off the site do not rise above 250 mg/l. Some monitoring off the site would be necessary too. Also some consideration should be given to levels of other parameters such as sodium levels which may be of concern.

4.6 -The impacts of dewatering during construction of the circulating water tunnel are apparently considered to be minimal since they are not discussed in any detail. Can

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a statement to this affect be made?

4.6.2.1 -The plan to limit chlordie concentrations would have to insure that no offsite wells have concentrations of 250 mg/l. Also as previously noted other parameters such as sodium may be of concern.

5.2.2 -What are the conditions for "extended abnormal operation"? What would the pumping rates be and for what duration? In the event that a slurry trench wall is installed and the till area as shown in Fig. 6-3 is an important aquifer boundary, do these statements need to be modified? On the basis of the limited hydrogeologic data available and the limited analysis done so far, aren't these unsupportable conclusions?

-The leaching field proposed is relatively large and will certainly have some adverse effect on the ground water regime even if it meets the State of Rhode Island Standards.

6.1.2.2 -A complete study of the ground water regime is needed. In addition to the aquifer recharge characteristics the recharge cycle (quantity, timing variability, etc.) needs to be defined. Also any underflows that may enter the site through the preglacial bedrock valleys need to be defined. A definition of the hydrologic regime adequate to predict offsite effects of construction dewatering and normal plant operation will require some offsite testing and monitoring. Offsite testing should include: test boring, geophysical measurements, water level measurements, water quality measurements, pump testing, and stream flow measurements. Offsite monitoring should include: water levels, water quality, and stream flows. Direct measurements of fresh ground water outflow at the freshwater salt water interface may also be useful for quantifying current conditions and predicting future impacts.

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6.2.2 -Post-construction monitoring of ground water should include: water quality, water levels and possibly freshwater outflows.

9.2.3.3.11 -The Westerly site appears to fall almost entirely in the lower Pawcatuck River Basin (see USGS WSP 2033). The area certainly is a ground water recharge area although it appears to be isolated from major ground water aquifers in the area. Shelter Harbor and Shady Harbor are both in till areas and would have only limited ground water supplies. Salt water intrusion should not be a problem at this site so that Westerly may be and probably is superior to the Charlestown site from a hydrological viewpoint.

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Review of Sections of NUREG-0529 Draft Environmental Statement related to construction of New England Power Units 1 and 2 (NEP 1+2)

Saul B. Saila
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Kingston, R.I. 02881

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This review is restricted to those sections of the Draft Environmental Statement for which comments were requested by the Governor's Energy Office. They are sections 2.7.2, 3.4, 3.6 (as appropriate), 4.3.2, 4.6, 5.3, 5.5.2, 6.1.5, 6.2.5, 9.3.2, 9.3.3, 9.3.4, 10.1.2, 10.3 (as appropriate), B.4, Appendix C, and Appendix E. Endorsement or disapproval of other sections of this Draft Environmental Statement or of the proposed project is neither expressed nor implied by this review and the comments which follow.

General Comments:

1) To the best of this reviewer's knowledge there is no operational information for the New England area marine environment on the entrapment-impingement impacts of the proposed submerged circulating water intake structures to be located approximately 600 meters (2000 feet) offshore in Rhode Island Sound. Therefore, the applicant's entrapment-impingement predictions for many of the representative important species are considered to be conjecture. Very little is known regarding the behavioral responses by various life history stages and by seasons of some fishes and motile invertebrates to the proposed intake structure. However, it is generally recognized that large objects located on or near the sea bed serve as attractants for many species of marine life. It is the judgement of this reviewer that because the applicant's entrapment-impingement predictions are not developed from either information on prior operational experience of submerged offshore

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water intake structures in this region or from any substantial experimental data on behavior of local representative important species related to the proposed intake structures, the applicant's impact predictions for entrapment-impingement are not considered adequate for proper evaluation.

2) This reviewer's definition of monitoring includes the purpose of detecting changes from the present state of the biological community and of the environment. Baseline data are required to provide a standard against which to detect such a change. According to the Draft Environmental Statement (NUREG 0529), such baseline data have been gathered. However, for monitoring to be sensitive to detecting changes, these changes must be specifically defined in terms of particular types and degrees of impact, and the accuracy and precision of the available baseline data must be specified. To the best of this reviewer's knowledge no evidence is presented by the applicant to specifically define the nature of the methodology to be applied to further comparisons of marine communities in Ninigret Pond and Rhode Island Sound with existing baseline data. Neither is any indication given of the level of impact which the past baseline studies and proposed monitoring program will be able to detect with reasonable confidence. This reviewer contends that inadequate planning has gone into studies designed to test the null hypothesis that no change due to the plant impact have occurred. For the baseline and proposed monitoring studies, neither the level of impact to

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be detected nor the ability of the existing or planned programs to detect change have been defined.

Specific Comments:

1) There is a contradiction in the applicant's entrapment-impingement prediction and the EPA's evaluation (E-60) with data presented on pages 2-33 and 2-42 of the main report (NUREG-0529). According to Raytheon Company - Juvenile Squid Populations in Block Island Sound, 1977, Final Report (1978) large quantities of all life history stages were found in Block Island Sound. Indeed, squid were a very important part of the otter trawl collections in the vicinity of the intake structure - comprising up to 37% of the catch at BISA (cited from 2-42). Also squid eggs and adults were seasonally abundant in the vicinity of the proposed intake structure. The omission of this information from both the applicant's evaluation and the EPA evaluations render them completely invalid with respect to this species.

2) Page 5-3, 5.3.1.1. water intake. No details on the applicant's statement that previous operating experience has demonstrated the effectiveness of the water intakes utilizing a velocity cap in reducing fish entrapment are provided. This reviewer has been unable to find any such information for the Northwest Atlantic marine environment, and only very limited information elsewhere. One such reference is Weight, R. H. 1958, Ocean Cooling Water System for 800 MW Steam Power Station, Proc. ASCE 84(P06): 1888-12, 1888-16, and another is Richards, R. T., 1978, Present engineering limitations to the protection

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of fish at water intakes. In: 4th National Workshop on Entrainment and Impingement, L. Jensen (ed.), E. A. Communications. Although this paper suggests up to a 90 percent reduction in losses, it should be pointed out that a survey of fish impingement at 32 power plants in the U.S. (Stupka and Sherm ANL/ES-56, Vol. III) indicates that impingement data alone provides no basis for decisions on intake technology.

3) Page 6-10, 6.1.5.2. Aquatic, and page 6-14, C.2.5.2. Aquatic. This information is abbreviated to the point of being meaningless.

4) Page 6-10, Ecological parameters. The changes made in the ecological monitoring program include decreasing replicates and increasing ichthyoplankton sampling stations. What was the basis and justification for these changes?

5) Page 9-104, 9.3.4 Alternative fish return system. This reviewer disagrees with the staff statement that "it is believed that impingement will not be a serious problem at this plant". Totally inadequate information or conjecture form the basis for this opinion, and it is not justified. Furthermore the staff recommendation that "if impingement rates become unacceptably high during operation, and survival of entrapped fish and shellfish is found to be good, installation of a return system with Block Island Sound as the receiving location is recommended" is considered inappropriate. The reason is that the probability of substantial survival of representative important species of fish and shellfish is considered to be very

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low due to the physical stresses from pressure changes and fluid stresses, as well as mechanical injuries.

Instead of considering alternative fish return systems, it is recommended that mitigation measures, such as direct replacement of entrapped-impinged organisms be considered.

8) Pages 4-17, 4.3.2.2 Turbidity and sedimentation, last paragraph. This reviewer challenges the statement that recovery of areas subjected to dredging or spoil deposition is generally relatively rapid. See: Saila, S. B., 1976, Sedimentation and food resources: animal-sediment relationships. In: Marine Sediment Transport and Environmental Management, Ed. by D. J. Stanley and D. J. P. Swift, J. Wiley and Sons, pp. 379-492. On the basis of a recolonization model and empirical data derived from Rhode Island Sound the time required for return of a dredge spoil disposal area to 95 percent of its equilibrium population was estimated to be approximately 11 years. In certain areas recovery of perturbed areas may be quite slow. The rate of recolonization is site specific and is also related to the extent of the disturbed areas. The inferences drawn by the applicant in the recovery of disturbed sediments for the region areconsidered to be overly optimistic.

7) Page 5-39, 5.5.2 Aquatic, 5.5.2.1 Impingement. To this reviewer it seems unreasonable to predict the impingement rates of the proposed power plant based on extrapolations from available data and various types of multiplier factors. The

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highly unpredictable nature of serious impingement events should be recognized and a plan should be developed to demonstrate how to cope with such a serious event - if it should occur. That is, both the problem of how to minimize the frequency and occurrence of impingement losses and how to cope with a serious impingement event (when it occurs) should receive careful attention.

8) Page 5.65, Table 5.32. This reviewer questions the EPA assessment of operational impacts on long-finned squid and lobster with reference to both entrainment and entrapment-impingement. The reason for these questions is that not enough is yet known of the spatial and temporal distribution of lobster larvae in the vicinity of the proposed intake, and the inferences drawn for the squid were based on the assumption that they were not present in the area.

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TO: Dr. Clem Griscom

FROM: Scott Nixon
Associate Professor of Oceanography

DATE: June 29, 1979

RE: Review of NRC Draft Environmental Statement

I have reviewed sections 2.7.2; 3.4; 3.6; 4.2; 4.3.2; 4.6; 5.2.1; 5.2.2; 5.5.2; 6.1.5; 6.2.5; 9.3.4; 10.1.2 and 10.3 as requested. Because of a lack of time I have given Appendices C, E and F only cursory review. Overall, this is a better prepared and written document than many of the ES manuscripts I have reviewed. It is also much more concise and qualitative in its analysis. While I have included a list of specific points of question or disagreement, there are three major concerns which I think need to be emphasized.

1. The major impact on Ninigret Pond is likely to come during construction of the plant. While the NRC staff is clearly aware of this, they seem willing to accept at face value the bland assurance that "good construction practices" can eliminate the potential destructive input of sediments, oils, metals, nutrients, etc. that their own analysis indicates as likely to be a problem. I think we should be considerably more skeptical - all it takes to put a real slug of sediment into the pond or a large dose of oil is one careless bulldozer operator. It seems very unlikely to me that a construction operation of this magnitude could possibly be carried out so close to the pond without a serious adverse impact. Whether or not we are willing to accept that impact is another question, but it weakens the credibility of the entire report to suggest that construction impact on the pond can be virtually eliminated by being careful. As they say, "wishing don't make it so." The ES should be much more specific in this regard in spelling our mitigating measures to be required - e.g., very wide buffer strips of perhaps 500 feet or more.

2. One of the problems with having state regulations is that some people will use them to carry more than they can bear. Throughout my sections of the ES, the NRC staff ducks the question of sewage impact from the 3,000 construction workmen by simply assuming that the leachfield used will comply with state laws and therefore be acceptable (see. 3.6.2, p. 3-13). There are a number of problems with this approach. I cannot imagine that anyone who knows this area would seriously propose that a 3 acre leachfield for 3,000 workers reaching to within 50 ft. of the edge of Ninigret Pond would not have a potentially major impact on water quality. One of the problems is that the soil along the backside of the pond is poorly sorted glacial outwash till through which water moves relatively quickly. Such soil gives a good "perk" test, but the problem is that the water (sewage) will be moving quickly toward the pond. Our thermal IR photographs clearly show groundwater inputs along the back of the pond. It seems to me that this is a potentially serious problem that has not been adequately covered in the ES.

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3. The coupling of Ninigret Pond and Block Island Sound through the breachway means that the pond can be influenced by the cooling water intake and outlet ports, even though they are located offshore. While I have not reviewed the section on hydrodynamic modeling, the NRC staff states in these sections that the warm water plume from the cooling system will reach to the breachway with a ΔT of 3-4°C. Given the uncertainty in such calculations, it may be considerably higher under some conditions (strong on-shore wind, etc.). Is it possible that this warmer water could be carried into the pond and result in an appreciable increase in the average pond temperature? This point is not discussed in these sections of the ES and it seems to me to be something we ought to resolve. A similar concern arises in the discussion of plankton mortality. While I agree with the ES that this factor is probably not important if the volume of water passing through the plant is compared to the volume of Block Island Sound, I wonder about the pond. How much of the water entering the pond will have passed through the cooling system before it gets into the breachway. Similarly, how much of the ebb flow from Ninigret Pond (or possibly the other ponds) will pass through the system? It seems to me that we ought to know something about the interactions between the breachway and the inflow and outflow sites, and not just look at the Sound as a whole.

More Specific Comments:

3.6.2, p. 3-13. How close to edge of pond will leach field for 3,000 workmen be? State standards are probably not adequate here.

Page 3-14. 15 mg/l for oil input tells us only the oil concentration, but not the number of liters of such oil discharge water- hence we don't know the oil input.

4.3.2.1, p. 4-16 A minimal dredge estimate for Pt. Jude would seem to be ca. 8,500 yd^3. Perhaps it should be required for the dredging to be restricted to ebb tides. The time of year should be selected so as not to conflict with fish migration.

4.3.2.2 Page 4-18. What are "stringent control measures" for reducing sediment input - a major problem in this pond. Where is the sediment going or likely to go if it is input from the site?

4.3.2.3, Page 4-19. Again, in spite of the admission of substantial impact from nutrients, low O_2, oil and metals, the staff consistently seems to be willing to accept that "good construction practices" will make everything all right- but specifically what are these practices, how are they be be mandated?

4.6 Page 4-29 Where is the "local area" for the sanitary wastes to be? Both Charlestown and South Kingstown are pressed for space. 4,000 people generate a lot of garbage.

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5.2.2 Page 5-3	Again, the sewage-groundwater problem is avoided by putting the responsibility on the state standards!
5.5.2.2 Page 5-45, 5-46	It is not clear that the entire volume of the euphotic zone of BIS is the appropriate hydrographic unit. The plankton dynamics have not been related rigorously to realistic estimates of advection at all, nor do we have the residence time of the water in the vicinity of the intake. How much of the water passing through the system enters or comes from Ninigret Pond?
5.5.2.2 Page 5-49, 5-52	It is not clear to me that the best way to put perspective on the potential loss of a given amount of fish is to compare the loss with the total R.I. landings of that species. For some species, much of the R.I. catch does not come from Block Island Sound. On the other hand, a portion of the BIS stock is landed in Connecticut.
5.5.2.3.3 Page 5-54	No reasons at all are given for increasing the estimated Tautog population by a factor of 10 in making this assessment of power plant impact.
5.5.2.4 Page 5-57	If the "avoidance temperature" for winter flounder is ca. 4°C on the basis of laboratory studies, and the "staff's" far-field temperature model predicts ΔT of 3-4°C over ambient at the mouth of the pond breachway during spring and fall, it seems to me that there is considerable reason to worry that migration between the pond and sound might be disturbed. After all, both estimates are subject to considerable uncertainty. I don't see that their conclusions follow from their own assumptions. Moreover, no avoidance data for other species using the pond are given (e.g. American eel).
5.5.2.5 Page 5-63	Even though there may be not toxic effects of the chlorine, isn't it possible that migrating fish may avoid areas with elevated chlorine as they do water with high temperature. If so, the plume of elevated chlorine water near the pond breachway may interfer with spawning migrations between the pond and the sound.
5.5.2.5 Page 5-63	Again, we find a great reliance on the R.I. State requirements for leachfield operations to protect the pond. This is avoiding the issue. The impact statement should critically review applicable regulations to see if they are adequate.
9.3.4 Page 9-104, 9-106	I agree strongly that the alternate fish return system should <u>not</u> use Ninigret Pond to return fish and other debris to the water. Not only is it possible that such a system would be harmful to the fish (as noted in the report) but it would probably also be disruptive to the ecology of the pond.

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REVIEW OF SELECTED SECTIONS
DRAFT ENVIRONMENTAL STATEMENT
NEW ENGLAND POWER UNITS 1 AND 2
DOCKET NOS. STN-50-568 AND STN-50-569

PREPARED BY

DR. MALCOLM L. SPAULDING
DEPARTMENT OF OCEAN ENGINEERING
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KINGSTON, RHODE ISLAND 02881

Sections Reviewed: 2.5.1; 2.6.4; 3.4; 4.6; 5.2.1; 5.3; 6.1.1; 6.1.4; 6.2.1; 6.2.4; 9.3.1; 9.3.2; 9.3.3

Section 2.5.1.1

No reference is made to F. Short's M.S. (Oceanography) thesis on modeling Ninigret Pond circulation dynamics using Leendertse's finite difference hydrodynamic model. This study is rather important in that a first attempt was made to relate flow resistance to the size and distribution of grass beds that dominate the shoreline areas of the pond.

While there have been at least two modeling studies of Ninigret Pond and one in depth field investigation by Conover, our understanding of the pond circulation dynamics is still very poor. From some of the simple modeling tasks it has been shown that wind induced forcing can markedly change the pond flow dynamics and Short has also noted the importance of the numerous grass beds. In addition, Conover noted times when the flow in the pond displayed a distinct two layer pattern. This could be attributed to abnormal fresh water runoff as well as the numerous fresh water springs along the northern edge of the western basin of the pond. Unfortunately, no consistent data set is available as of this time to sort out

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which are the processes controlling circulation in the pond. This is not the impression one gets reading the presentation given here.

Section 2.5.1.2

No comment.

Section 2.5.1.3

Another important bathymetric feature of Block Island Sound is a channel of approximately 80 feet in depth running from the northern tip of Block Island and terminating at the Race. The channel is bounded on the north by a gently sloping bottom and on the south by the Southwest Ledge and the Endeavor Shoals. This channel-like structure can be better seen in the three dimensional plot shown in Fig. 1 and the contour plot (Fig. 2).

Section 2.5.1.4

It would be extremely helpful to have a plot showing exactly where the coastal flood plain and in particular the 100 year flood plain is located relative to the barrier beach and the proposed plant site. Simply stating the definition is not very helpful.

Section 2.6.4

The purpose of this discussion on dispersion is not clear. After a lengthy discussion on data sources, model selection, and modeled scenarios, no results are given.

Section 3.4

Good concise presentation.

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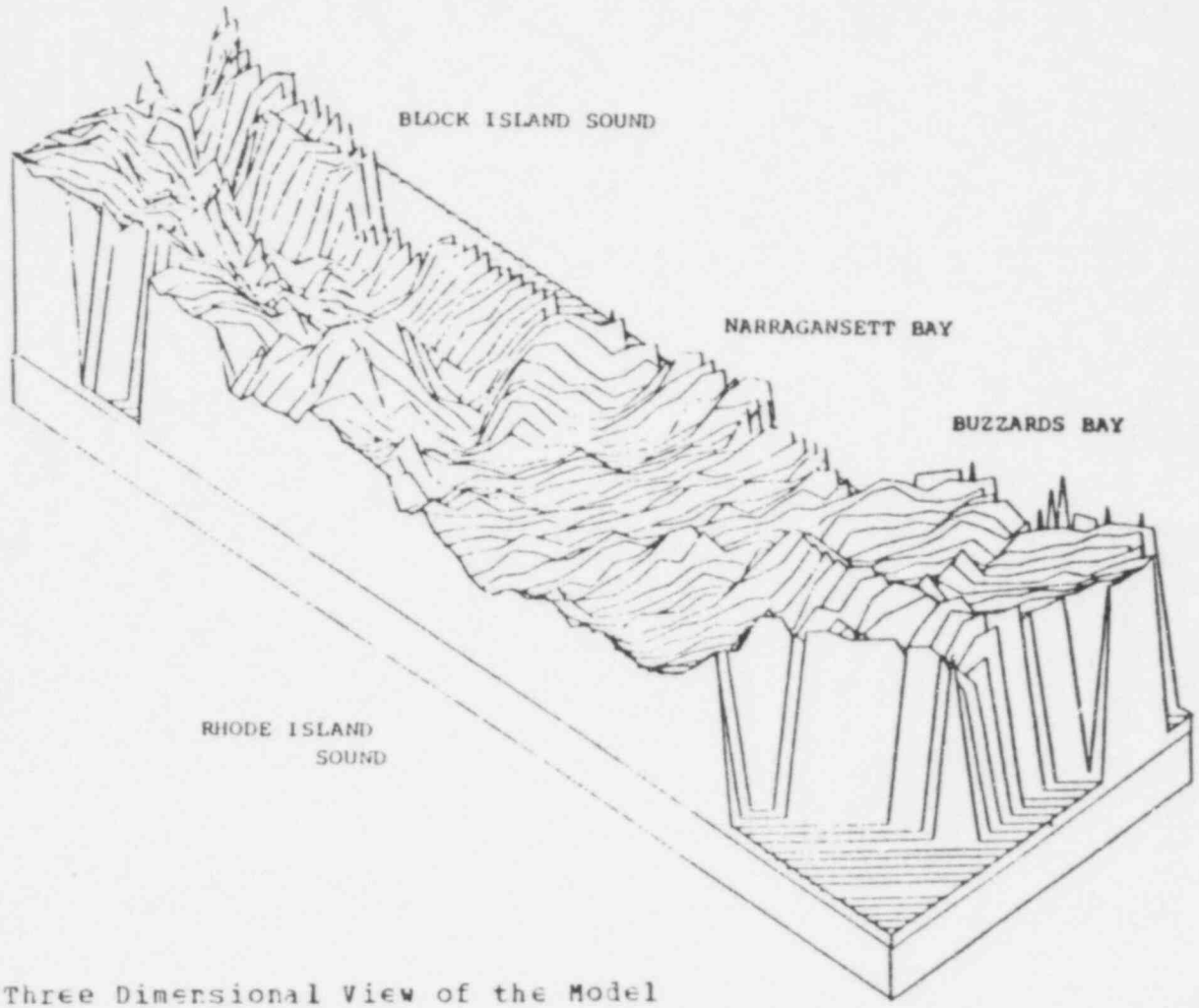

Fig. 1. Three Dimensional View of the Model Bathymetry for the Eastern Portion of the Study Area.

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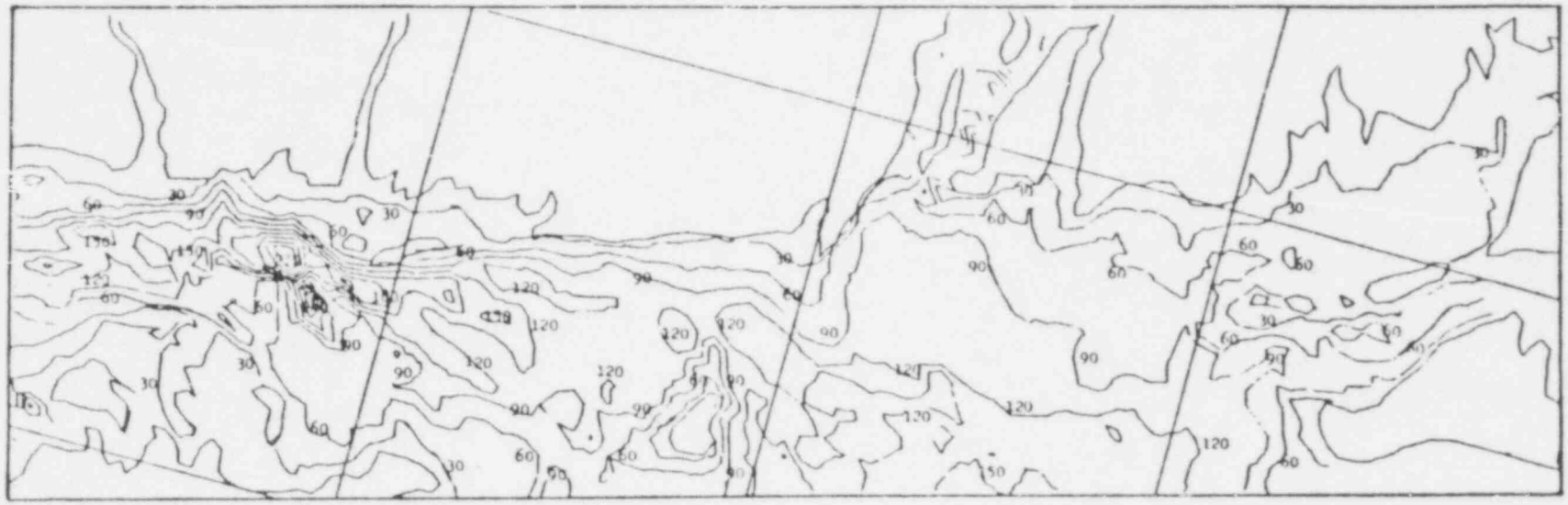

Fig. 2. Bottom Contour Chart for the Eastern Portion of the New England Intracoastal System (Model Bathymetry).

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Section 4.6

No comment.

Section 5.2.1

No comment.

Section 5.3

It should be noted that the currents used in Alden's near field physical model were sinusoidal with the ebb and flood speeds of equal magnitude but separated by approximately 6.2 hours. This representation is therefore only a first order approximation to the tidally induced flows in the study area.

It seems rather strange that given all the model tests performed by Alden for the near field simulations that a full tidal cycle test case for the exact discharge, and intake configuration of the proposed design was not run. It would appear that this test run is needed in order to perform an in depth evaluation of the near field temperature rise.

The value of velocity chosen for the near field case is open to questions. Typical surface currents in the area of the discharge system are on the order of .45 - .85 ft/sec (Raytheon, 1975). Running the physical model simulations at 1 ft/sec (Fig. 5.1 in the DEIS) which is roughly 60% higher than the values normally observed, leads to a significant lowering of the areas in the higher surface temperature rise isotherms compared to values typical of the average conditions. Unfortunately this representation in the near field is carried into the intermediate and far field analysis since the physical model provides initial condition information for these subsequent models.

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The transient longshore current tests performed by Alden appear to be in question because of the short duration of the test runs coupled with the plume interacting with the boundaries of the modeled area. As shown in Fig. 5.2 (DEIS) the simulation was run for approximately 1/8 of a tidal cycle and already the plume is beginning to interact with the boundaries of the physical model. Based on these observations, it is difficult to feel confident that the values predicted for the near field isotherm surface area are adequate for any more than a first estimate. The effects of heat buildup, as noted in the staff's analysis, are clearly missing.

The applicant's far field thermal model takes almost no account of the study area. While their procedure has all the important heat transfer and dissipation mechanisms several of the assumptions made appear to make the model a simple numerical exercise. Assuming that heated water will not move shoreward of a given line seems to be an arbitrary assumption unsupported by any data. In fact, Dr. Griscom (URI Division of Marine Resources) has shown that surface drifters released at approximately the intake site location move onshore very rapidly (in a matter of hours) during onshore wind events. Heated effluent could be expected to do the same thing. Observation of tidal currents also suggest that the tidal ellipses are not parallel to the shore in the vicinity of the discharge site (Raytheon, 1975). The tidal currents could, therefore, be expected to transport heated water shoreward during at least some portion of the tidal cycle. Therefore, the applicant's analysis is of questionable value due to the numerous unsubstantiated assumptions in developing his simple far field thermal model.

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Section 5.3.2.1

Good analysis and presentation.

Section 5.3.2.2

Note that the surface heat transfer value also includes convective heat fluxes from the sea surface.

The envelope of staff's analysis shown in Fig. 6.8 is not entirely clear. It appears to represent the upper and lower bounds of surface area for a given isotherm due to the variation of tidal velocity during the tidal cycle. Better labelling would make this a much more easily understood illustration. It would also help to have the values used by the staff and the applicant noted on the graph.

Since the initial Block Island Sound circulation modeling effort performed by Isaji and Spaulding was completed, additional modeling has been performed by Beauchamp (1978) and Gordon and Spaulding (1979) on predicting the tidally induced circulation in Block Island Sound along with the adjacent coastal waters. Figure 3 shows the nested grid structure of the model developed by Gordon and Spaulding (1979) while Figs. 4, 5, and 6 show a comparison of the computed to observed range, Greenwich high water interval, and Greenwich low water interval, respectively. It is clear from this comparison that the model adequately reproduces the observed tidal behavior in the study area. Comparison of the nested model to that employed for the staff's analysis shows generally good agreement in the study area thus providing further confidence in the staff's analysis of the coastal hydrodynamics.

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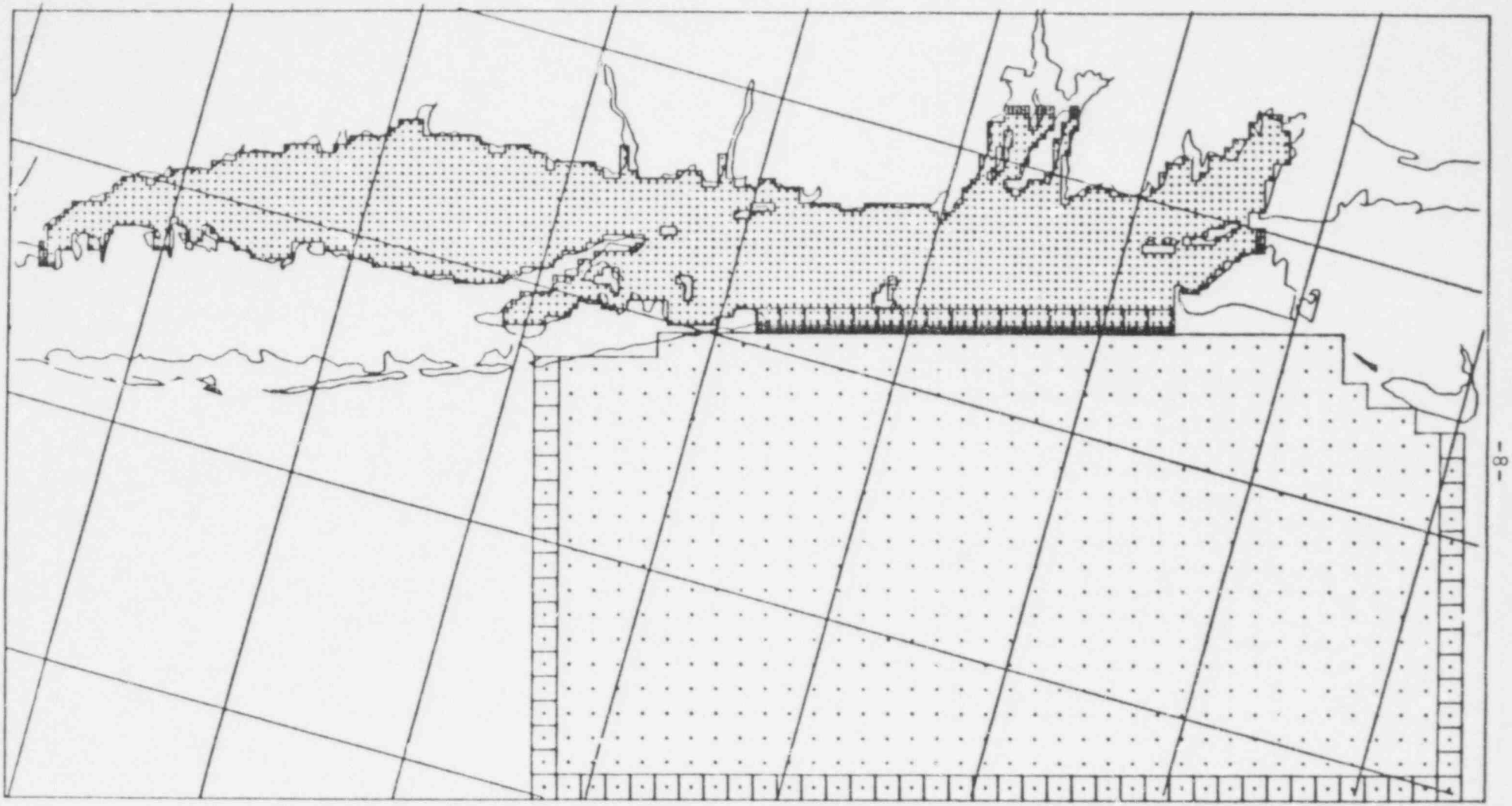

FIGURE 3. THE NESTED FINITE DIFFERENCE GRID SYSTEM. SPACING FOR THE THREE GRIDS ARE 3, 1 AND 1/3 NAUTICAL MILES

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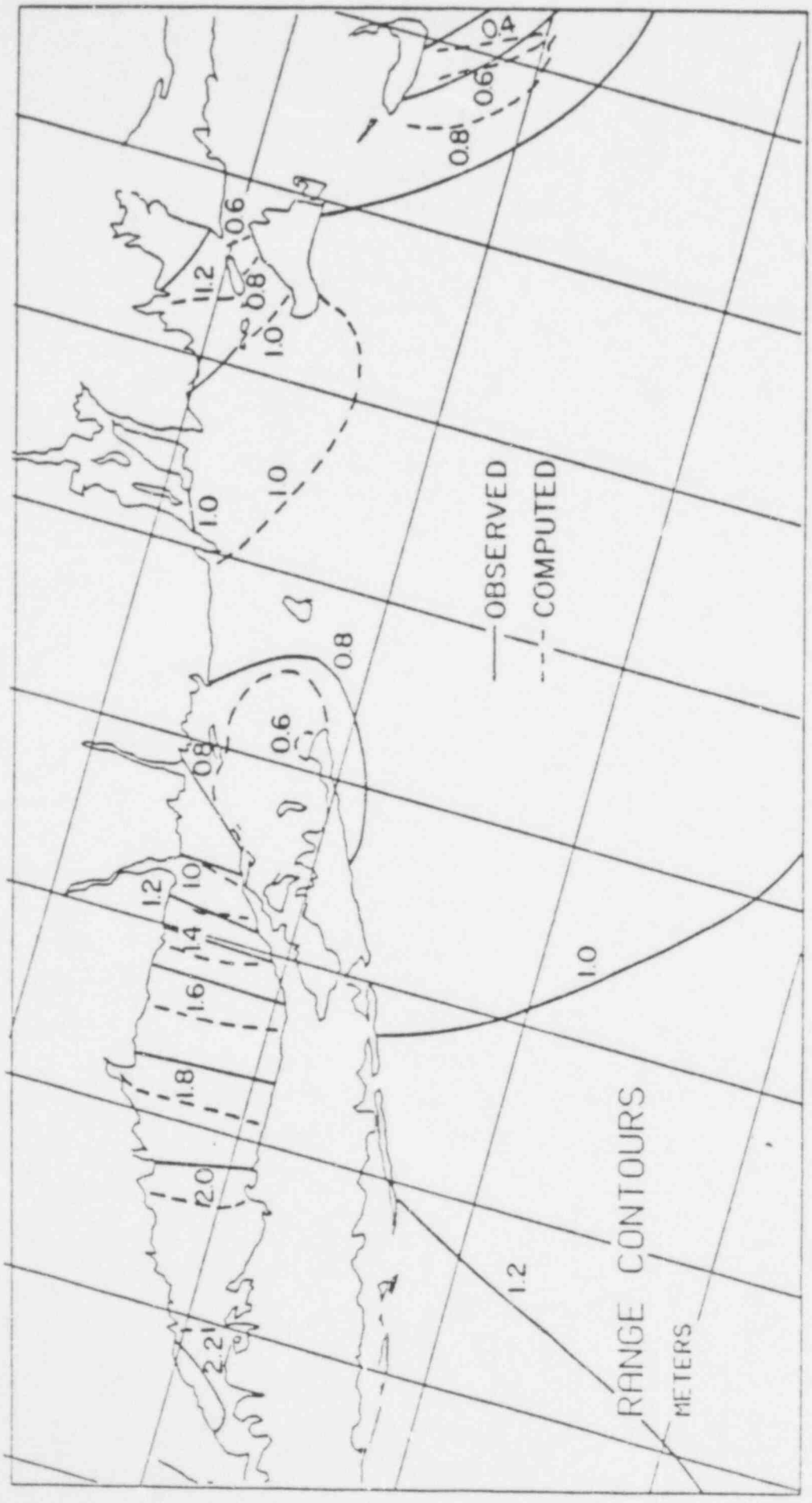

FIGURE 4. COMPUTED AND OBSERVED CO-RANGE CHART OF THE STUDY AREA

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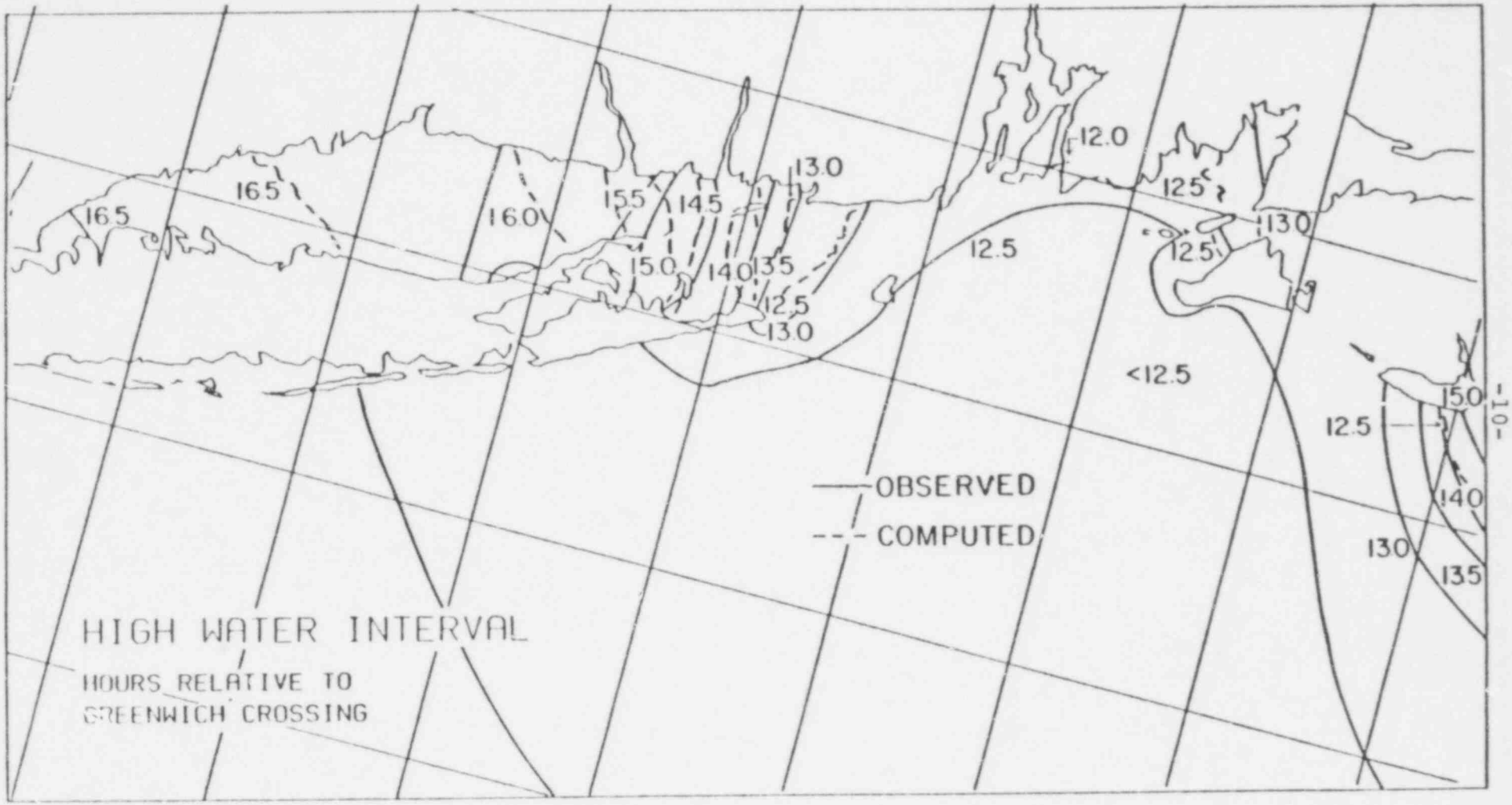

FIGURE 5. COMPUTED AND OBSERVED GREENWICH HIGH WATER INTERVAL CHART OF THE STUDY AREA

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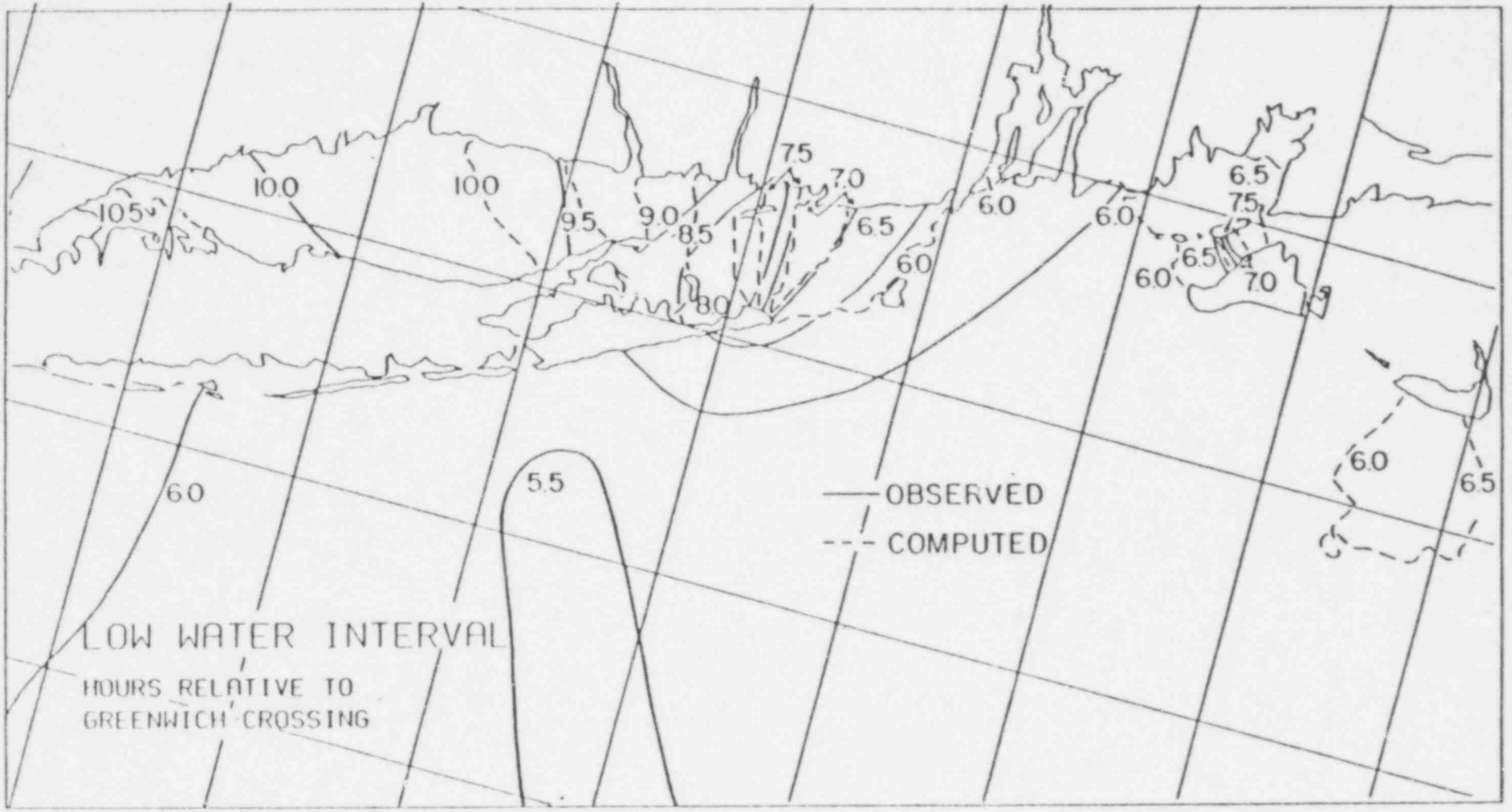

FIGURE 6. COMPUTED AND OBSERVED GREENWICH LOW WATER INTERVAL CHART OF THE STUDY AREA

AD-A093 685

Section 6.1.1

No comment.

Section 6.1.4

No comment.

Section 6.2.1

No comment.

Section 6.2.4

No comment.

Section 9.3

-One should note that 12 tidal cycles corresponds to approximately steady state conditions after starting the discharge at time zero.

-Labeling of Fig. 9.6 and in particular the numbers on the graph are not clear.

-The statement that "the size of the excess isotherms compared to the proposed design is approximately 10%" is misleading. The real influence of increased discharge flow is to decrease the area enclosed by the higher temperature isotherms and slightly increase the area of the lower temperature isotherms.

Section 9.3.1.2 and 3

Good presentation.

Section 9.3.1.4

What is the definition of flushing employed? Since Wang's model is driven by a semi diurnal tidal height boundary it appears

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that all the flushing must be caused by the wind. That raises the question as to how sensitive the flushing rates are to winds from directions other than the southwest. Would the impacts change if another wind direction were chosen?

Section 9.3.1.5

It is not clear why one would use the Quonset Point Naval Station wind data as input to the salt drift and deposition model unless the applicant can show the similarity in wind fields between the two areas.

In order to better evaluate the results of ORFAD it is absolutely necessary to have more details presented on how the experimental law extrapolation is applied. Are data points at all three levels used (10 m, 58 m, 91 m) and fit with a simple experimental profile or is only one point used? The difference between these two techniques could cause substantial changes in deposition predictions.

After a review of the Quonset Point Naval Air Station data, it appears that the information contains serious local effects or the wind rose shown in Fig. 9.9 is not correct. Figure 7 shows a comparison between the % observation of wind for a given direction between the Quonset data (9 year record) and a 5 year record taken at Greene Airport. Also shown are typical yearly data for the Greene Airport station indicating the year to year variation. It is clear from this comparison that while the winds at Quonset are dominated by the N, NNE, NE, and SW, SSW, S, the winds at Greene (approximately 5 km to the north) show considerably more winds from the NW quadrant. The Greene Airport station is also more typical

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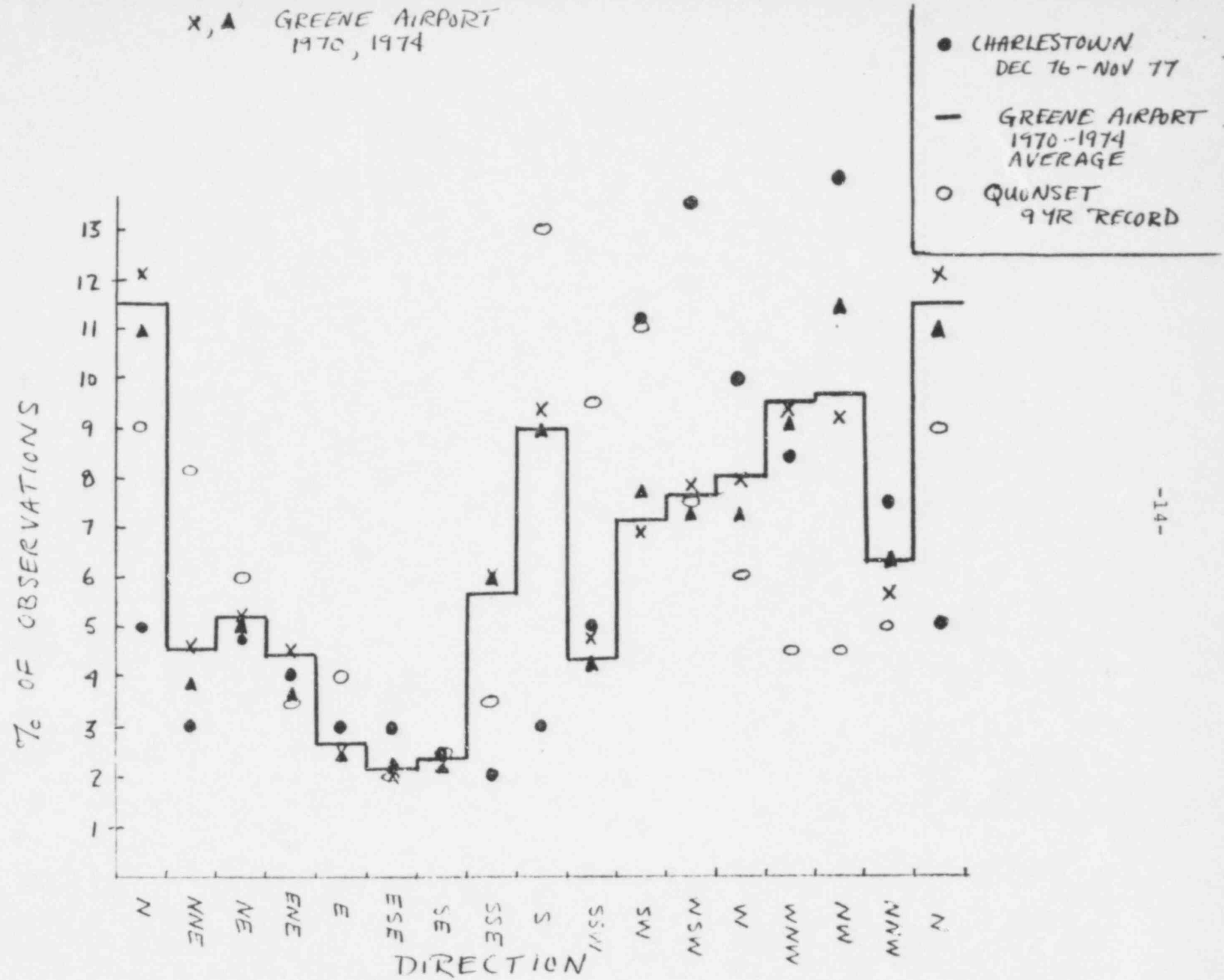

FIG. 7 COMPARISON OF CHARLESTOWN QUONSET POINT & GREENE AIRPORT DATA

of the Charlestown site and the U.S. Coast Guard observations at Point Judith Light House. In the absence of significant topographic features such as mountains, valleys, etc., it would appear that the wind patterns at Greene, Quonset, Charlestown and Point Judith would display similar patterns over a given year. Indeed this is the case except for the Quonset record.

Given that the Quonset data has been employed to "reflect long term meterological information", no indication has been given as to the likely year to year variations. Why couldn't the deposition patterns be run for several one year records at Quonset and these values compared to the long term prediction? This would at least give some indication as to the significance of year to year variation in predicted deposition patterns.

Because of the large difference between the applicant's estimates of deposition and those performed by the staff, it seems that some resolution should be made in order to realistically assess cooling towers as an alternative cooling system. Certainly the applicant could present the detailed justification for his calculations to include assumptions, use of available meterological data, and model formulation in order that the staff could resolve the discrepancy in deposition estimates.

It is not clear how the staff determined the ambient drift deposition from Block Island Sound. This point needs to be documented by references, data and/or calculations.

Section 9.3.1.6, 7, 8, 9 and 10

Reasonable analysis and conclusions noting the comments previously made on the application of the ORDAD code to the study site.

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Section 9.3.1.11

No comment.

Section 9.3.2.1

Good analysis and presentation.

Section 9.3.2.2

Good analysis and presentation.

Section 9.3.3

Good analysis and presentation.

It appears that the staff has correctly identified an obvious need to consider an alternative multiport submerged discharge located further offshore.

599109

REFERENCES

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Griscom, Clement, Division of Marine Resources, University of Rhode Island (personal communication), June 1979.

599110

REVIEW OF THE NUCLEAR REGULATORY COMMISSION's D.E.I.S. NEP 1 & 2

Niels West
Department of Geography and
Marine Affairs
University of Rhode Island

June, 27. 1979

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I have carefully read the DEIS NEP 1 & 2 and found it to vary greatly in quality. A number of critical comments covering the entire document will be made first, immediately followed by more specific points in the text. Where appropriate, these have been referenced.

General Comments:

It is quite clear that the reviewing agency (N.R.C.) has relied very extensively on the applicant's environmental assessment and only on occasion conducted independent analysis. This deficiency is particularly obvious in the sections dealing with socio-economic characteristics and potential impacts. While the socio-economic impact methodologies may not be as well advanced as those of the natural scientists, significant developments have nonetheless been made in recent years which, had they been applied, would have improved the document immensely.

It is curious that neither the applicant nor the N.R.C. has addressed the so-called "No Project" alternative as is required under NEPA and CEQ guidelines. This very serious omission gives the reviewer the impression that the decision to construct the proposed plant has been made apriori, the only outstanding issue being to identify the most appropriate geographical site. From a socio-environmental point of view, the impacts associated with the "no project" alternative could very well surpass all others should it be decided not to proceed with construction. This section should include a detailed temporal as well as spatial (geographical) analysis of future energy demand, in addition

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to the assumptions taken in making these projections. The "no project" alternative presumably would include social impacts caused by a given shortfall in electric power generation. This reviewer urges that the N.R.C. take the necessary steps to ensure that this and future DEISs include this important section.

Another critical general (overall) comment concerns the organization of the material presented. While it is recognized that the EIS has evolved immensely over its relatively short life and is likely to undergo still other drastic changes, common practice for nearly all agencies involved with N.E.P.A. and the EIS process is to describe the existing conditions and using these brought forward in time as the base line from which all subsequent impacts can be assessed. The existing conditions are not static (as is implied by the present document) but very dynamic. To properly assess the conditions which are likely to occur in 1987 against the conditions prevailing in 1978 or 1979 without projecting these forward in time under the "no project" alternative is clearly invalid. It is of course true that this complicates the analysis by requiring two sets of independent projections, one dealing with the existing conditions brought forward in time where comparative analysis can be made in the same timeframe between the "proposed" and the "no project" alternatives. An analysis that essentially compares socio-environmental impacts occurring at different time periods is more likely to obfuscate matters than to facilitate the environmental decision-making process which is one of the objectives of N.E.P.A.

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Since the present DEIS is largely based on comparisons between different timeperiods it obviously rendersmost of the findings and conclusions highly suspect.

A final general criticism concerns the incompleteness of the analysis. A good example, but by no means an isolated one, concerns the limited transmission line alignment assessment present in this document. It appears that great emphasis has been placed on describing and analyzing the impacts to the 604 acres which make up the NAPL site, yet the area which will be impacted by the transmission line alignment covers a much larger area (1754 acres) and appears not to have received close scrutiny by N.R.C. (4.1.3.). This portion of the DEIS recognizes the need for the analysis but assumes that these impacts can be minimized or at least satisfactorily mitigated (3.7.5.). The point is important and relates to the apriori decision discussed above. The proposed plant can not be licensed to operate unless and until it has been tied into new and/or existing transmission lines. Thus the nuclear plant and transmission line alignment should be assessed together and in as much detail as is required to identify and assess the total socio-environmental impacts. The courts have addressed this problem generically, although not as it relates to nuclear power plants. A comprehensive assessment of all the impacts likely to result from both power generating plant and such facilities as are required to operate it as a system must be completed before approval can be granted. It is clear that the courts now require applicant's to take a holistic view, analyzing not only the site specific impacts, but also the impacts which the total project is likely

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to cause. By specifying that the transmission line impacts will be analyzed at some later date implies that these can be mitigated and will not seriously affect the decision to construct the proposed project. It is therefore recommended that detailed on-site transmission line assessments be included in the DEIS by N.R.C. or its designate. This is particularly important in light of the several threatened or endangered plant and animal species which may find suitable environments on or in close proximity to the proposed transmission line alignment (2.7.1.4).

Specific Comments

The descriptive sections dealing with the socio-economic characteristics of the three towns appear deficient in several respects. The analysis of the housing stock within the three towns' proximal area is made more complicated by virtue of the fact that the towns are popular summer recreational spots and to a varying degree are in the process of becoming suburbanized. The result is that a significant portion of the housing stock is being "recycled" into year-round housing. These conversions have long been popular with the large student population residing off campus in Washington County during the winter. These arrangements represent a viable symbiotic relationship between summer residents, real estate interests and the students. While recreational homes are still being built in South County (Washington County) the larger proportion of recent additions to the housing stock consists of year-round homes occupied by either locals or commuters. The net impact is a tightening of both the

recreational housing inventory as well as year-round homes for reasons outlined above.

It is thus highly questionable how much "vacant" housing stock can be found locally to serve a portion of the transient project related labor force indicated for the three town area without seriously impacting the local lower income segment of the permanent population (4-20).

The DEIS is deficient in its assessment of the current school population (2.8.3.3) within the proximal study area. Two points bear noting. As has been stated (Table 2.10), all three towns grew between 1970 and 1977, a trend which is projected to continue although not at rates comparable to those of the immediate past.

It is indeed curious that no private (parochial) school population was included in this analysis (2.8.3.3). This point is equally true for the Environmental Report Vol. 1. from which the N.R.C. apparently abstracted its information. Both applicant and the N.R.C. completely failed to incorporate the sizeable private school population which is being serviced by several religious schools and a growing number of private schools offering alternative educational opportunities to the school aged children. The omission seriously affects the conclusion which suggests that the "project induced" school population will not seriously impact any of the three systems. While population growth due to natural increases has declined nationally, such trends are not likely in areas which are being impacted by extensive employment opportunities as will be the case during the construction period of the Charlestown nuclear

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facility. Most of the families moving into South Kingstown, Charlestown and Westerly in search of employment are likely to be below median age and include school aged children. These families are likely to require educational space within the respective school systems.

As is correctly stated, most of the growth ascribed to both Charlestown and South Kingstown is projected to occur as a result of inmigration rather than as the result of natural increases (2.43). It is indeed curious that no analysis has been conducted by either applicant or reviewer regarding the rate of residential development in the Washington County area. It is recommended that steps be taken to validate the sources and methodology used by both the R.I. D.O.E. and R.I. D.E.D. for tables 2.13 and 2.9.

The South County Hospital has recently added a new wing to its facilities (2.8.3.4). This should further increase this hospital's capacity to serve the project related increase in population.

No attempt has been made to assess the project-related demand for increased law enforcement and fire protection for the three towns (2.8.3.5). This section only describes the existing conditions and does not pursue the topic further. Specific attempts should have been made to project the manpower needs in the four basic services (police, fire, education and town administration) caused by the increased population projected for the three towns. This analysis could have been based on existing population/service manpower ratios, assuming that the in-movers would be socio-economically indistinguisable from

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the population existing in the communities. In the opinion of this reviewer this section is one of the weakest and should be extensively reworked.

Much has recently been written about the appropriateness of allowing construction activities on the floodplain. These concerns cover both the coastal zone and the river. It is noted that the elevation of the proposed site will be raised through fill and excavation to 20 feet above MSL (4.4), some four feet above what is currently required under Executive Order 11988 (1977). It has been noted that extensive excavation will be required by the applicant yet no detailed topographic map (one or two foot contour) has been enclosed identifying in detail the areal extent and location of fill and excavation relative to the highest known storm surge line.

The proposed environmental modification created by the barge traffic (4.1.2) to the head of Salt Pond raises serious questions concerning the environmental impact of this operation. It is noted that this site only serves recreational boaters[1] yet it is unlikely that commercial fishing vessels would utilize this facility to any great extent following excavation of a channel in a substantial portion of Salt Pond. The environmental impact caused by this has not been addressed. While disposal is mentioned as a problem which needs to be resolved, no discussion has been included which proposes solutions to this particular problem. It represents one additional example of

[1] A few seasonal small inshore lobster boats also frequent this portion of the bay particularly in the wintertime.

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an impact which assessment has been deferred.

It is stated in several places that wildlife which is being disturbed by noise, excavation and construction activities (4.3.1.1 and 4.3.1.3) will occupy adjoining habitats. This statement does not agree with current ecological knowledge. When established ecosystems are intruded upon on the scale proposed in Section 4.3.1.1 the disturbed wildlife will attempt to establish a new equilibrium. The total biomass may be larger or smaller than before and may in part be made up of the displaced wildlife, however such ecological changes are likely to displace existing biomass in adjoining ecosystems. There is very little opportunity for displaced wildlife to temporarily occupy adjoining ecosystems without seriously impacting the often fragile ecological balance. Thus the implied statement in 4.3.1.1. simply is not true and cannot be supported.

The analysis of the Housing and Residential distribution of workers (4.4.2) should have been modeled. Many basic assumptions have been stated. It would not appear an impossible task to develop an empirical model which would project the location of the worker population. While such an effort is likely to be far from foolproof, it does retain one critical advantage ower the procedure used in the DEIS which alone should prove worth the additional effort. By modeling these impacts, the various factors hypothesized to influence the locational aspect of the employee's residential location behavior have been both identified and quantified. Any errors can be corrected for or fine-tuned as new and qualitatively superior information becomes available. To estimate the

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location of existing housing vacancies in 1984-1985 on the basis of the availability of vacant housing in 1977 simply is not valid. The American population is a highly mobile one approximating 20 percent per year nationally. This means that a significant proportion of the population living in the three town impact area will have changed residence between 1977 and 1984-1985. The estimate made by N.R.C. does not take into consideration the extensive residential developments which have characterized all three towns. It would appear that an environmental suitability analysis would have been a more appropriate means by which this very important problem could have been assessed. Efforts made by Greenberg represents a suitable starting point for estimating the future population in the three towns.

It is clear that the temporary population impact caused by construction activities will significantly impact the existing municipalities, and while the cost of these may be covered by the increased rateables, the fact is that no attempt has been made to address these except in a very general manner. This omission seems peculiar in view of the importance which CEQ places on addressing socio-economic impacts on par with those impacting the natural environment.

The reviewer agrees with N.R.C. that recreation constitutes an important contribution to the South County economy. The recreational opportunities span virtually the total range of activities associated with a water environment from surf and offshore fishing through swimming, surfing, diving, racing and

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cruising including such popular passive activities as sightseeing. The recreational impact analysis constitutes approximately one very descriptive page (4.4.6) in which it is concluded that the impact on recreation will be minor. No discussion of the methodology utilized, samples taken etc. have been included. Considering the great importance which Rhode Island places on outdoor recreation, particularly marine recreation, and considering the substantial sums of money the state derivesfrom visitors, this reviewer takes issue with both conclusion as well as the manner in which the "analysis" has been conducted. No attempt has been made to analyze the impact the proposed project will have on the various recreational users. The connection between sports fishing and the severe reduction in the tautog and cunner population is not made let alone analyzed in detail (5.5.2.3.3). As mentioned elsewhere (Sisson) the two species constitute one of the mainstays of both surf and offshore sportsfishing in Rhode Island.

Some of the impact statements have been misplaced within the text, e.g. 5.1. This section discusses impacts of transmission line operation. Most of the potential impacts discussed in this section relate not to the operation of the line but its construction. What is not included in this section is the economic impacts which the transmission line may have on adjoining real estate. While a tight methodology may not yet exist, an attempt should have been made to develop estimates for key land uses rather than discarding these impacts by a statement implying few if any.

While this reviewer was not specifically requested to review

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the demand estimation sections (8.2) a careful review of these pages was made. The N.R.C. staff is to be commended for the overall thorough comparative analysis, particularly the evaluation of the projections made by NEES and NERA. In this context it should be remembered that the external conditions have changed significantly in the few months since these sections apparently were written (8.2.2). It is noted that the National Research Association (NERA) projects growth in the region's total electric demand ranging between 5.2 per cent and 7.7 per cent between 1975-1985. These estimates have been based on regression analysis which apparently incorporates pre-OPEC blockade consumption data. These estimates were modified downward by the N.R.C. staff, and closely match the "no project" alternative by the Demand Subcommittee of the recently completed New England Energy Congress (NEEC).

The comparative analysis between electric power and solar for space heating (8.2.3) is encouraging even though much more effort should have been made to analyze this and other forms of alternative forms of energy. The underlying assumptions of this DEIS are indeed remiss in not assessing the demand for energy based on a dispersed population model.

The brief section dealing with conservation (8.2.5) corresponds well with NEEC conclusions on energy demand in the short term (1985).

Appendix N is a brief description of a constraint which according to N.R.C. has been used as a criterion in siting nuclear facilities

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(N.R.C. Regulatory Guide 4.7., Rev.1, Nov. 1975). Two criteria are used to determine if a given site is suitable. The first requires that the population density extending to a distance of 30 miles from the proposed site should have a population density of less than 500 persons per square mile at the time of initial operation. If this requirement can not be met, N.R.C. and the applicant is obligated to give special attention to considering alternative sites with lower population densities.

N.R.C. did not review and address this point in great detail. A rough calculation of the population density in the four Rhode Island counties which are likely to be included (all or in part) within 30 miles of the proposed site suggests that the existing population density exceeds this criteria. This calculation is based on conservative R.I. Department of Economic Development (1977) population estimates which for Charlestown, South Kingstown and Westerly fell below those reported by N.R.C. Nor do these figures include the sizeable transient population which visits the southern portion of the state during the summer.

N.R.C. discarded the guidelines almost immediately after having stated them (N-4) by requiring population densities at alternative sites to be lower than those characterizing the present site by a factor of two. No discussion is presented which justifies this particular function. The point is significant and bears upon a philosophically potentially more important point which will be touched upon next.

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If indeed safety considerations deem it necessary to locate nuclear facilities in areas of low population density, that portion of the population who live in the hinterland of such a facility has in fact been denied equal protection under the law. The risk (however small) is carried by a specific segment of the population who (a) are not being compensated for this increased risk, and (b) who have not individually or collectively had an opportunity to affect the siting decision in any meaningful way. While it is recognized that several attitudinal surveys have been taken in Charlestown and vicinity, these appear not to have affected either positively or negatively the decision-making process.

NOTES

New England Energy Congress, Final Report of the New England Energy Congress: A Blueprint for Energy Action, Tufts University, Medford, MA, 1979

Greenberg, Michael R., "A Test of Combinations of Models for Projecting the Population of Minor Civil Divisions," Economic Geography, (April, 1972), 48,2,179-188

Sisson, Richard T., "A Preliminary Evaluation of the Magnitude of the Sport Fisheries in Narragansett Bay, 1970," Rhode Island Division of Fish and Wildlife, Marine Fisheries Section Leaflet # 34, Providence, n.d.

599124

Comments on NUREG - 0529

Draft Environmental Statement (USNRC)

Related to Construction of

NEW ENGLAND POWER UNITS 1 and 2

Published May 1979

Prepared by:

James E. Hickey and James Nolan

Division of Occupational Health and
Radiation Control

28 June 1979

8001250

General Comments

1) Radiological Impact of Routine Operation:

The Nuclear Regulatory Commission (NRC) staff's general findings indicate that, barring a major accidental release, the expected radiological impact on man and biota of the construction and operation of the proposed facility will be negligible. To arrive at this finding, the NRC staff compared the information submitted by the Applicant in his Environmental Report (ER) and Preliminary Safety Analysis Report (PSAR) against the requirements of NRC regulatory guides. A major determination in this matter relates to the ability of the proposed liquid and gaseous radioactive waste systems (RWS) to control radioactive effluents from the facility within the design objectives for radiation dose in accordance with Appendix I, 10 CFR 50. The NRC staff found that the proposed systems, if manufactured, installed and operated properly, promise to control radioactive effluents to a fraction of the Appendix I guidelines. This, they conclude, will result in radiation doses to individuals and to the population within 50 miles of the facility which are insignificant when compared with the existing natural background radiation in Rhode Island of 100 millirem per year per person.

While we are in general agreement with the staff's determination, we take note of the preliminary nature of this determination. The actual performance of the RWS is dependent upon many factors other than design criteria and can only be judged under long term operational conditions. One of these factors relates to the number of unscheduled releases which may occur at the facility and for which the RWS may not always be sufficient to limit releases to Appendix I guidelines. Although historical data for similar plants would indicate that these conditions occur on a periodic basis, their impact is not included in the routine Appendix I analysis. The staff alludes to this matter when mentioning that actual license conditions may allow releases greater than those presently projected. We, therefore, believe that a routine radiological monitoring program which goes beyond that presently planned is indicated to assess the impact of facility operation on the environment. We also believe that data produced by the monitoring program should be available to our agency without prior screening by the Applicant. Specific comments on the Applicant's proposed monitoring program are provided later.

2) Radiological Emergency Planning and Response

In Chapter 7 of the Environmental Statement the NRC staff finds that, "the environmental risks due to postulated radiological accidents are exceedingly small..." This finding is based upon: the very low probability of major postulated accidents as confirmed by experience; the Rasmussen Reactor Safety Study; and, the design capabilities of the Applicant's engineered safety systems to limit radioactive releases should major accidents occur.

We defer to the NRC staff's technical judgement on this matter. However, we wish to mention several points relating to this matter which are perhaps outside the staff's consideration and responsibility under present guidelines. One is the questionable reliability of the postulated accident scenarios in predicting actual accident sequences, personnel responses to accident situations and resultant consequences of accidents. Preliminary information on the Three Mile Island (TMI) accident casts doubt upon the reliability of postulated accident scenarios. Another point regarding the environmental impact of accidents relates to the readiness both in terms of training and equipment, of off-site personnel to evaluate environmental impact from accidental releases, especially short-term impact. When accidents or incidents occur, the state government has the responsibility to inform and, if appropriate, to reassure the public concerning radiological consequences.

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We now know that theoretical projections of impact are not sufficient during these episodes, and that reliable real time measurements of environmental levels together with on-line facility status information are necessary. Informed decision making by State Government authorities regarding immediate protective actions requires the ability to quickly measure the radiological levels in the environment independently of the facility. This, in turn, requires very early notification to off-site authorities when potential accident sequences are discovered by facility personnel.

We, therefore, believe that there is a need for the Applicant to provide detailed emergency response planning information both in terms of the measurement equipment in place and available, and in terms of his assurances to fully inform and cooperate with off-site authorities who have emergency responsibilities.

Specific Comments (J. Hickey)

1) The Applicant in the Introduction to his latest revision of his Environmental Report (ER) continues to indicate that he has followed the outdated Revision 1 of Regulatory Guide 4.2 in preparing the ER. We suggest that the Applicant clarify which Revision he has followed. In any case we believe that the Applicant should be required to conform to the latest guides and regulations.

2) Various statements by the Applicant in his latest Revision of his ER are confusing regarding his response to the requirement for Appendix I, cost-benefit evaluations on alternative Radioactive Waste Systems (RWS). The Applicant has revised Section 5.2.4.4 of his ER to indicate that the necessary information is contained in Appendix C.3 of the ER. However, the Applicant further comments in Section 10.7 and 10.8 of the ER that Appendix I evaluations for liquid and gaseous RWS are unnecessary. Further, the NRC Environmental Statement in Section 3.5 refers the reader to the Chapter 11 of the NRC Safety Analysis Report for a discussion of the RWS cost-benefit analysis required by Appendix I. No such specific discussion was found. We suggest that the area of costs versus benefits of alternative RWS be specifically discussed by the NRC in the final Environmental Statement; that a statement appear regarding the staff's opinion on the adequacy of the Applicant's analysis; and that the Applicant be required to clarify, correct and/or delete any contradictory statements or information contained in his Environmental Report on this subject.

3) In Table 15.4-3 of the PSAR, the Applicant continues to indicate that 1.09×10^9 Ci of ^{85}Kr would be released in the realistic case during the first two hours of a loss of coolant accident. This appears to be an error inasmuchas the amount of ^{85}Kr indicated to be released is greater than the combined facility inventory of ^{85}Kr. Also it is greater than the 3.87×10^3 Ci to be released during the first thirty days in the same accident situation. The Applicant should correct this table and any dose calculations based thereon.

4) The Applicant has not yet clarified to our satisfaction whether he will notify the State Radiation Control Agency in the event of unscheduled releases of radioactive materials to the environment below the level necessary to declare a General Emergency. It is our position that such notifications are essential to our timely participation in the off-site assessment of the consequences of such releases. Furthermore, it is our desire that the Applicant agree to notify the Agency at the earliest possible time of any transient operational condition, whether scheduled or unscheduled, which could produce transient radioactive releases.

While necessary assurances can undoubtedly be obtained by regulatory or other means, we prefer that the Applicant make the necessary assurances by appropriate statements in his ER and PSAR.

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5) Natural Background Radiation

A significant source of natural radioactivity in Rhode Island has been found to be drinking water from wells which extend into granite formations. These types of wells are the major source of water in the area around the proposed facility and will most likely be the type of wells used by the facility for other-than cooling purposes. We suggest that the preoperational environmental evaluations include a radiological evaluation of appropriate water sources for natural radioactive materials.

Comments on Subsections 6.1.3 and 6.2.3 and Section 7 of the Charlestown EIS
J. Nolan

10 CFR 50.34 (a) contains provisions designed to assure that releases of radioactive material from nuclear power reactors to unrestricted areas during normal reactor operations, including expected operational occurrences, are kept "as low as reasonably achievable" (ALARA). As part of this effort, Appendix I of 10 CFR, Part 50, contains specific guidance on design objectives and requirements for monitoring both the effluents from a nuclear power plant and the environment surrounding the facility. This radiation monitoring program must provide data on measurable levels of radiation and radioactive materials in the environment and the plant emissions to evaluate the relationship between quantities of radioactive materials released in effluents during normal operations and the resultant radiation doses to individuals from principal pathways of exposure.

Further guidance on environmental surveillance is also contained in Regulatory Guide 4.8 (December 1975), "Environmental Technical Specifications for Nuclear Power Plants," particularly Table 2, which outlines the scope of an acceptable environmental surveillance program for monitoring routine releases of radioactive materials. The pre-operational and operational environmental radiological monitoring program of the applicant contained in Table 6.2 of the EIS follows the Regulatory Guide quite closely and seems to satisfy the minimum requirements for monitoring routine releases.

Each applicant for a construction permit is required by 10 CFR 50.34 (a) to include a discussion of preliminary plans for coping with emergencies, and Appendix E of 10 CFR, Part 50, establishes minimum requirements for these emergency plans. Subsection C of Appendix E deals with environmental monitoring and requires that the applicant have means for determining the magnitude of the release of radioactive materials, including criteria for determining when protective measures within and outside the site boundary must be taken to protect the public health and safety and prevent property damage.

To aid the applicant in developing a plan, the NRC has developed Regulatory Guide 1.011 entitled "Emergency Planning for Nuclear Power Plants." In this document the NRC recognizes that an important element of emergency planning is the active participation in the planning process by those state and local agencies who have emergency response roles. The Radiation Control Agency is responsible by Rhode Island law to advise the Governor regarding the degree of potential hazard to the public and the need for protective actions resulting from releases of radioactive materials. As a result, we are particularly interested in the assessment actions to be performed by the applicant in case of an accident. Specifically, we feel the applicant should give reasonable assurance that the magnitude of releases of radioactive materials can be determined, that the magnitude of any resulting radioactive contamination can be determined, that projected exposure to persons off-site can be estimated, and that emergency action levels specified in the Rhode Island Protective Action Guides can be determined, all in a timely manner. We do not believe the radiological environmental monitoring program proposed by the Applicant will meet the objectives outlined above and therefore

does not meet the criteria established in Appendix E of 10 CFR, Part 50, and Regulatory Guide 1.011.

In the wake of the Three Mile Island incident, it is clear that the probability of a major accident at a nuclear power facility is not vanishingly small. The conclusion in Section 7 of the EIS that, when the consequences of each type of accident are weighted by probability, the environmental risk is very low is probably quite true, but it is important that the consequences of non-routine releases be evaluated as promptly and as accurately as possible. We have learned as a result of Three Mile Island, that the protective action decision makers need the best information possible, either to allay the fears of the public, or to recommend prompt and decisive action where indicated. In order to achieve this objective, we feel the Applicant's program should also include, at a minimum, the following:

1) Increased number of TLD sites for more accurate external dose estimates.

2) Standby air particulate and gas samplers located at each TLD site for more accurate internal dose estimates.

3) An off-site radiation monitoring system with detectors capable of measuring exposure rates from tenths of an mR/hr to thousands of R/hr. This system should have real time capability and should consist of a sufficient number of detectors such that off-site dose rates and plume location should be accurately determine.

4) These real time dose rates, the source term from the plant, and the meterological data from the site should be provided to the Radiation Control Agency at a terminal to be located at the Health Department along with access to the Department of Energy ARAC model.

We feel these modifications will provide the Agency significant additional infomation with which to make protective action evaluations and therefore fulfill its legal responsibilities if a non-routine off-site release should occur. We also feel these additional requirements are necessary to meet the criteria of Appendix E of 10 CFR, Part 50.

593129

REVIEW

SOCIO-ECONOMIC IMPACTS OF PLANT CONSTRUCTION AND OPERATION

(Secs. 2.8, 4.4, 4.6, 5.6, 10.3 and 10.4)

of

Draft Environmental Statement

New England Power Units 1 and 2

NUREG-0529

May, 1979

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&
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June, 1979

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General Comments:

I. Significant, localized, socio-economic impacts resulting from the large scale construction and operation of nuclear power plants are a function of at least three fundamental parameters: (1) inmigration patterns of construction employees (including the mix of commuters, travelers and inmovers); (2) tax revenues and distribution thereof, provided by the facility; and (3) expenditures for direct construction-related materials and services provided by local suppliers. From these and the area's socio-economic base, the bulk of indirect and induced impacts arise.

In the present DES, each of these three fundamental parameters is estimated univariately -- according to a single forecasted scenario. Thus, the DES provides us with only a very narrow corridor of anticipated happenings, when we should expect the possibility of a very broad range. For example, the single assumption of an inmigration ratio of 10% of total construction employees "drives" much of the DES analysis of impacts on housing, schools and community services and leads to rather minimal impact conclusions. The justification given in Sec 4.4.1 for the 10% inmigration rate is hardly adequate to suggest that this estimate is "reasonable", much less the "most probable" as is called for in the CEQ guidelines, para. 1500.8(a)(3). Consequently, the DES fails to address the spectrum

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of inmigration induced impacts amongst which the most probable case would fall. And since the magnitude of the impacts are not simple multiples or fractions of the magnitude of inmigration, adequate information for assessing the impacts of higher or lower inmigration rates is absent.

II. In those sections dealing with socio-economic impact, no consideration is given to the cumulative influence that the possible simultaneous construction of NEP I & II, Millstone III, Pilgrim II, Seabrook I & II, and/or Montague could have on anticipated patterns of labor migration and materials/services expenditures. Further, no mention is made of pending offshore oil development which could impact the study area as well.

III. Secondary social and economic effects are given only cursory treatment. For example, population changes that could ensue from secondary economic effects (the creation of additional retail and service trade jobs) are not addressed, although the CEQ guidelines state: "Such secondary effects ... may often be more substantial than the primary effects of the original action itself." (Para 1500.8 (a)(3)(ii))

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Specific Comments:

Section 2.8 Social Profile

1. Para 2.8.3.1 In referring to year-round housing, the DES states," ... the market in all three towns is tightening." To this point, the DES should address not only relative reductions in the number of vacant units, but also the inflationary pressures that this phenomenon is having on residential prices. This could then be carried forward in subsequent discussions of construction-related impacts on housing (4.4.2).

2. Para 2.8.3.7 In discussions of sanitary landfill sites, the report makes no mention of existing capacities, nor of the tremendous difficulties that the impact towns, particularly South Kingstown, are having with solid waste management.

Section 2.9 Attitudes Toward NRP 1 & 2

1. This represents an interesting and rather complete summary of major opinion polls conducted to date as well as reference to opposition and ongoing debates. The DES states that these points and the uncertainty

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associated with the use of the NACF, "... have caused a noteworthy social impact." Yet this "noteworthy social impact" is ignored in the benefit-cost summary of the DES (Section 10.4).

Section 4.4 Community Impacts

1. (4.4.1) The DES improperly reflects the Department of Labor's Construction Manpower (Labor) Demand System labor force projections, even though they are correctly presented as much higher than those estimates given by the applicant. First, the CMDS estimates do not account for absenteeism and less than full time workers, for the CMDS estimates are based on work-months and work-years. Secondly, the increasing craft labor requirements do not include additional labor needed to meet NRC and EPA standards that may ensue after 1981. Dr. W.R. Shriver, one of the principal authors of CMDS, estimates that the CMDS figures underestimate the employment of labor for the proposed project by about 10%. (See DES reference #4-3, p. 26). Thus, we might expect that labor figures contained in the DES are low by 10% and that subsequent labor-related impacts are correspondingly (although not equally) underestimated.

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2. (4.4.1) The DES staff considers the applicants' 10% labor inmigration rate reasonable based on the experiences of other New England nuclear plants, particularly Millstone I & II. During the course of a major construction labor study co-conducted by this reviewer (DES reference 4-3), power company spokesmen for Millstone I & II, Pilgrim I, and Seabrook I & II indicated that they kept no direct records of labor inmigration. Since the DES projections are justified as "experiences" which were apparently not empirically documented, and which may be based on estimates for a sample of one (Millstone), a priori we can hardly consider the rate "reasonable," much less most probable. That estimates of this rate are critical to subsequent analyses involving population-induced impacts is obvious.

3. (4.4.1) The distribution of labor force requirements across the construction period (Table 4.4) should be qualified by noting the recent experiences of at least two nuclear plant projects. At Millstone III, the construction schedule re: labor requirements has been dramatically decellerated and at Seabrook I & II dramatically accellerated.

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Variances in attendant socio-economic impacts as a function of labor demand schedules should at least be generally mentioned.

4. (4.4.4.1) The DES states that "All three communities have adequate sanitary landfill sites... "At least one of the three towns, South Kingstown, is presently experiencing critical difficulties with its landfill site and solid waste disposal in general.

5. (4.4.7.2) Additions to regional employment and income resulting from construction-related materials and service expenditures should be estimated. Regional employment and income multipliers available through the Harris Regional Economic Input-Output model could prove useful in making very rough approximations.

6. (4.4.7.3) The DES states, "The property tax impact of NEP 1 & 2 would also change if the plant were to cease operating prior to the projected year of full depreciation." This statement needs much fuller explanation, possibly including a tax revenue schedule for varying durations of operation.

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Section 4.6 Measures and Controls to Limit Adverse Impacts

1. (4.6.1.1.21) Offsite trash disposal areas should be identified if the applicant intends to make use of such.

Section 5.6 Community Impacts - Operation

1. (5.6.1) "Approximately 780 operational workers, plus families ..." should read "including families."

Section 10.4 Benefit Cost Summary

1. (10.4.1.7) The 5% inflation rate referred to here is apparently the anticipated annual escalation in operating payroll. In section 4.4.7.1, the escalation rate for construction payroll was estimated at (6% per year). Is there justification for either or both of these figures? Does the discounting procedure used in calculating the 1988 present worth of the total operating payroll suggest that payrolls are estimated to increase at only half the overall economic inflationary rate ("discount rate"), or does "discount rate" refer to the applicants cost of capital or some other notion? In essence, to what specifically does discount rate refer?

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2. (10.4.2) Again, escalations of costs are set at only half the discount rate. If present value is used in its common sense to refer to discounted purchasing power of revenues, or expenses, then apparently it is anticipated that the utility will hold energy generation cost escalations to one half of the anticipated inflationary rate. Is this reasonable? If so, how is it justified? If this is fully explained in reference D-9, then that explanation should be summarized in a footnote in the DES. This comment applies to Appendix D as well.

533118

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June 28, 1979

General Comments

The site selection evaluation sections are not sufficiently objective as to the methodology employed to be analyzed by approach. One must either agree or disagree with the staff's conclusions.

A significant improvement would be to explain the methodology used and objectify it. As explained in the specific comments section of this review, the Comerford site seems to be "obviously superior" to Charlestown given the Callaghan-Comerford employment study results.

The staff's treatment of the "eliminated alternatives" was very impressive. However I would like to have a list of all eliminated sites included in the EIS along with statements about why each one was eliminated from consideration.

Recent developments in the nuclear area and changes in public opinion may generate criticisms of the EIS which might never have been voiced otherwise. I feel the final section might be more critically received now. But this is outside the realm of the review. Possibly a policy statement from the NRC should address needed changes in the review process to reflect new developments.

Sincerely,

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Assistant Professor

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1. Sec. 9.2.1, p. 9-23

In explaining the staff's site selection evaluation methodology in paragraph 4, the variables used to measure each dimension are not introduced. More specifically, it would be helpful to present the variables used to measure each of the dimensions ("aspects") in table or matrix form. The reader would then be able to evaluate the comprehensiveness of the methodology used by the staff to evaluate the applicant's site selection process.

In Sec., 9.2.3.3, pp. 9-38 to 9-79, the following variables were used to evaluate 12 candidate sites and compare them with Charlestown. General characteristics, hydrology, water quality, aquatic ecology, terrestrial resources, socioeconomic impact, and population. These bases of comparison could be introduced and compared with the applicant's variables. Then, summaries of similar methodologies gleaned from the literature could be presented for comparison.

Additionally, a similar table or matrix of the criteria used by the applicant could be included so that both parties' approaches could be compared. Essentially it bothers me that both approaches have face validity but the reader is in the dark about thir construct validity.

2. Sec. 9.2.1, p. 9-29

> Ref., "3. the fact that a clear and substantial superiority should exist in the magnitude of environmental impacts...,"

What is meant by "magnitude?" There must be a more objective way to explain what the NRC looks for to determine whether a site should be rejected.

Similarly, "obviously superior," the overall criterion for selecting an alternative site is too subjective for a "cost benefit" analysis. If

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it's really a cost benefit model, specify the relationship between costs and benefits in dollar or percentage terms which would be the criterion for rejecting the applicant's site.

3. Sec. 9.2.3.1, Evaluation of Applicant's Site Selection Process

In table 9.9, p. 9-33, it is indicated that the applicant estimated labor availability at Charlestown site as follows:

"Excellent supply of skilled labor in a high unemployment area." The Callaghan & Comerford labor study for the R.I. Governor's Energy Office did not support this optimistic assessment. The Comerford, Bear Swamp, Shelburne and Litchfield sites were felt by the staff to have less favorable employment environments than Charlestown. Could the Callaghan-Comerford findings, which showed less favorable employment prospects for Charlestown than the applicant implied, move any of these four sites into a more "obviously superior" position?

According to this reviewer's reading, less than favorable employment circumstances for Charlestown would eliminate the major non-financial factor (and employment problems are, at least, partly financial in nature) acting against the Comerford facility and make it "obviously superior" to Charlestown (Incidentally, there is no connection, to my knowledge, between my name and the name of this alternative site!).

Furthermore, from Table 9.9, p. 9-33, the Comerford site would involve $200 million more than Charlestown in total cost differential. Relative to inflation effects on initial cost estimates, this is a small amount.

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4. Sec. 9.2.3.1, pp. 9-32 to 9-35

I think the staff has done a commendatle job of handling the so-called "eliminated sites." But it would be helpful for the public to know all of these sites and the major reasons why each was eliminated.

5. Sec. 10.2 Relationship Between Short-term and Long-term Productivity, p, 10-3

It is unclear in the introductory portions of this section whose productivity the section addresses. Is NEPCO's productivity at issue, the region's, America's, or man-kind's?

If productivity is defined as some measure of output per unit of capital investment, NEPCO's investment to date in this project should be considered. Also, other construction-related firms have made investments either directly and indirectly related to this project.

The point is that the beneficial effects on the area's economy of investments made to date have probably been significant and could be discussed to give a more accurate depiction of the project's advantages.

6. Sec. 10.2.2.1 Land Use

In estimating possible lost agricultural production, however small the affected area might be, dollar costs should be estimated.

Many of the items in Appendix O should be re-evaluated and rephrased in light of recent developments in the industry. Public opinion might flare up at some of the opinions presented by the staff in this section.

593142

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University of Rhode Island

REVIEW OF ECONOMIC ANALYSIS OF ALTERNATIVES FOR CHARLESTOWN NUCLEAR POWER PLANT AS SET FORTH IN DRAFT ENVIRONMENTAL STATEMENT OF NUCLEAR REGULATORY COMMISSION, MAY 1979 (NUREG 0529)

For Governor's Energy Office, Rhode Island
Submitted June 26, 1979

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MY ASSIGNMENT

I have been asked to review the sections of the DES on the comparative economics of the proposed Charlestown nuclear plant with generation by coal and other alternatives. My sections are: 9.1, 10.2, 10.4, 10.5 and Appendix D.

My review is structured as follows:

1. A brief background statement of the scope of the project and the appropriate response for an economic analysis of costs.

11. An itemization of the essential factors that must be specified in an NRC economic analysis, and a parallel evaluation of how far each of these items has been covered, or not covered by NRC staff. This is done on a scale of 10 for the optimum response and showing for each item what part of 10 has been covered by NRC, in my estimation. These quantifications are necessarily approximate, but relatively valid.

III. An item by item review of the sections assigned to me on the sections assigned to me on the alternatives to nuclear power other than coal.

IV. Nuclear and coal generation

V. Conclusion

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I. BACKGROUND

The DES is for a 2 unit nuclear power plant of 1150 MW costing $2.8 billion. Since this assumes a 5% escalation to 1988, and inflation rates have been higher, we may take a rounded cost of $3 billion. Also, since provision is made on the site for another 2 units, the cost in 1988 dollars could go to $6 billion.

The investment, at either the 3 or 6 billion levels, more than justifies a thorough, comprehensive and adequate study of the comparative (competitive) economics of the proposed plants versus coal and other alternatives.

Under certain circumstances, the economic study can be crucial to the question of whether to build a nuclear power plant. If the economics for nuclear were no better at best, or worse, than coal, say, then the cost-benefit question arises of why build the nuclear plant and subject RI and neighboring states to the costs and risks of possible meltdowns, low level radiation during routine operation, and the presently unsolved waste storage for thousands of years. This economic possibility happens to be well within the range of the best economic studies I have seen, even including that of the NRC in its DES.

Contrariwise, if nuclear were clearly and substantially cheaper than coal or other alternatives, there would then be the massive, often subjective, task of measuring against this benefit the costs noted in the above paragraph. This possibility appears to be much more remote than the opposite possibility.

I will now address myself to the question of the adequacy of the NRC Staff's "independent" economic analysis.

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II. REQUISITES OF AN ADEQUATE ECONOMIC ANALYSIS

Factors which are essential to a comprehensive statistical and qualitative analysis are listed in Table 1. The explanatory adequacy of the NRC staff analysis as contained in the DES is rated for each factor on a scale of 10. The number 10 represents optimal adequacy. The rating can only be approximate, but is an indicator of the area of adequacy. A 2, for example, says that the staff's treatment of the factor is not far from "0", but has some small amount of explanatory and analytical value.

My matrix shows 10 factors for nuclear and coal. Half have been given virtually no qualitative analysis in depth. Except for O & M, the other are close to zero. The average for nuclear is 1.3, for coal 0.7. Just what these low ratings mean is now explained for item.

1. Capacity factor definition etc. How this is defined can make a 3 to 5 percentage point difference. For Millstone 2 nuclear power plant at Waterford, Connecticut, eg, the monthly "Gray Book" report shows the following capacities:

Nameplate rating	910	MW
Design electrical rating, net	830	
Maximum Dependable Capacity, (gross)	842	
Maximum Dependable Capacity, (net)	810	

Unit capacity factors are shown for MDC net and DER net, but not for nameplate. In this case, the MDC capacity factor is 11% less than that based on nameplate rating.

The curious fact is that the Federal Power Commission from the beginning has expressed capacity factors only in terms of net generation and nameplate rating. The problem for individual plants and

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other capacity factor definitions has arisen pretty much only since the nuclear power plants have come in.

The only objective capacity is the nameplate rating fixed to the generator by the manufacturer. It is true that companies may unintentionally misreport nameplate ratings, but on the whole errors will be symmetric for other definitions, so that nameplate remains the best single basis for capacity factor.

The NRC staff estimates do not specify which basis is used for capacity factor, but I believe that MDC net is used, because this is the definition which NRC appears to favor in, eg, the Gray Book when calculating actual versus potential energy production monthly.

I would recommend that nameplate ratings be used by NRC.

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TABLE 1: EXPLANATORY ADEQUACY OF NRC STAFF ANALYSIS

ITEM	10 = optimal adequate	
	NUCLEAR	COAL
1. Capacity factor: a conceptual, definitional, functional and methodological examination	1	1
2. Senescence: of plant & capacity factors	2	0
3. Economic life of plant	2	?
4. Lifetime capacity factor (1+2+3)	2	1
5. YoYo effect, with histograms. More Important, perhaps, than capacity factor	0	0
6. Operation and maintenance costs: historical vs design	5	5
7. Scale (size) effects: for primary and secondary nuclear circuits	0	0
8. Technological constraints - cost & safety welding art for containment vessels and piping and tubing, valving, pumps, metering etc	0	0
9. Human factor constraints, costs, safety: a. management & labor at power plants b. Similarly at equipment manufacturer c. Similarly on construction site	0	0
10. Low sulfur Eastern coal, as alternate for Western coal in New England	N.A.	0
Simple arithmetic average	1.3	0.7

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2. Senescence

This is the decline in capacity facto4 with age of the plant. It has been given virtually no attention in American literature.

New England Power (NEP) assumes a rise in CF to the 6th year and a leveling off thereafter at 76.2%:

Year 1	59.2%
Year 2	60.9%
3	66.8%
4 & 5	71.0%
6 +	76.2%
30 yr. average	74.5-
40	74.9
28	74.34
20	73.6

NRC staff assumes a 60% CF with a range of 50% and 70% but does not specify any senescence factor.

ERDA (Energy Research and Development Administration) in a 1975 publicati'n assumed the following senescence:

Year 1 & 2	65%
3 to 15	75% high 70% low
16 to 30	minus 2% per year to a minimum of 40%

Source: ERDA, "Total Energy, Electric Energy, and Nuclear Power Projections, United States" (Feb. 1975) p6.

In my discussions with RWE, the largest German electric utility they felt that senescence was a correct principle, but would start the decline in CF at the 18th year.

It is obvious that senescence is a crucial factor in the lifetime economics of a nuclear power plant, or coal plant and that the absence of any consideration in the DES is a serious flaw.

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3. ECONOMIC LIFE OF PLANT

With the high capital intensity in a nuclear plant, and a high but somewhat lesser intensity for coal plants, the life assumed for the plant is vital in any economic analysis. The standard assumption of government and utilities is 30 years for both plant types, and this is the assumption of the NRC staff. The assumption, however, is not pure. At pages 7-1, 10-12 and 10-15 the staff also uses 40 years. Some utilities, including NEP, have begun to use a 40 year life, apparently in order to make nuclear costs seem lower, but this is unsystematic. NEP's assumed life in the DES is not specified, and is perhaps 30 years.

A most significant deviation from the 30 year assumption for nuclear is embodied in the study done for NEP by Arthur D. Little Company in 1975, which is understood to be the basis on which the NEP directors decided to build the RI nuclear plants. This report does not state the assumed lives of coal and nuclear, but at my request NEP found out from ADL that a 30 year life was assumed for the coal plant, but 28 years for nuclear.

This drop to 28 years for nuclear is important not so much for that particular number, but as an indicator that ADL felt that nuclear would have technological problems which would shorten its life. The 28 is simply a proxy for this principle, and not significant as that particular number by itself.

The French use a 20 to 21 year economic life for nuclear, the UK 20 years at a derated CF, the Germans 20 years. RWE, the German utility, uses a technical life of 30 to 32 years, but an economic life, based on internal calculations, of 20 years,both for nuclear and for coal. Dr. Schoch, who is manager of the generating station at Mannheim in Germany and head of the national TUV as well as the

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Baden TUV, has told me that he thinks the nuclear plant life is under 20 years, and would have to cost more to bring it up to 20 years.

I have tried to give some idea of the importance of the assumed life of a nuclear versus a coal plant in the comparative cost analysis. The omission of any analysis on this point in the DES is serious.

4. Lifetime capacity factor

This is dependent on points 1,2,3, above and nothing more need be added here.

5. YoYo effect

If one looks at the annual chart of daily CF's for nuclear power plants, which are known as histograms, he will see that these CF's rise and fall like a yoyo with considerable frequency. This fluctuation factor can be more important than the CF itself. Thus, two plants with 55% CFs could be entirely different if in one the ava-lability can be controlled to be had at the peak, but if in the other this available was only poorly predictable. An example is the cold spell in March 1978, when there was an auxiliary peak, but both Millstone nuclear plants were shut down.

Dr. Schoch, who must sell his power wholesale competitively, told me he could not operate with the nuclear histogram patterns. He must have 90% availability at the peak in winter, with 3 hour overload capability. The somewhat stochastic quality of the nuclear histogram is one of the main reasons, he told me, for his not buying a nuclear plant.

There is no attention to the yoyo, or reliability, effect, as distinguished from CF, in the DES and virtually none elsewhere in the literature. It must be an essential of any valif economic analysis of nuclear power.

5[illegible]

6. Operation and maintenance costs

O & M costs are available for nuclear and fossil fuel plants in the necessary detail mainly in the FPC/FERC Form-1 reports of utilities. Since so much of the low capacity factor below the 80% design for nuclear plants is due to technological problems, they should be reflected in erratic patterns of O & M from year to year as CF fluctuates. As CF drops, O & M, if fully reflected in utility accounts should rise. Conversely, for fossil plants, assuming in general that lower CFs are due to load following (ie. drops in demand), O & M should drop.

Staff uses a comparison of 2 x 1150 MW nuclear units with 3 x 767 coal units with flue gas desulfurization (w/FGD). O & M is given as follows:

	Mills per Kwh		
CF	NUCLEAR	COAL	NUCLEAR = 100
50	7.4	11.2	151
60	6.2	16.1	260
70	5.4	9.4	174

To see what comparisons of actual plants look like, I prepared the following table for the Millstone nuclear power plant #1, 662 MW, commercial in 1970, with the Canal fossil fuel plant in Massachusetts, 542 MW, commercial in 1968.

	Mills/kwh		Nuclear	CF	
Year	Nuclear	Canal	= 100 ,	Nuclear	Canal
1976	3.73	1.45	39	65	73
5	3.09	1.00	32	67	81
4	2.72	1.38	51	62	71
3	4.07	.74	18	32	81
2	2.42	.72	30	55	78
1	.91 (*)	.78	86	62	78

(*) First year of operation, which is usually low in O & M.

I've also compared 3 Midwestern plants burning coal with the Kewaunee nuclear plant. The coal units range from 460 to 668 MW, the nuclear

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is 535 MW. Kewaunee O & M was 3.17 mills/kwh in 1976, compared with .66, .69 and .84 mills for the 3 coal plants. With Kewaunee at 100, the coals were 21,22 and 26. CFs for coal were 60%, 52% and 49%, and for Kewaunee 72%. Point Beach nuclear plant, one of the better managed apparently, operated at .92 mills, with the coals then being 72, 75 and 91 percent respectively of Point Beach.

What this means is that the actual numbers, selected at random, are opposite to the O & M relationships of nuclear and fossil fuel p. .cs assumed by the NRC staff. This illustrated my point that some qualitative analysis of O&M is essential in an economic analysis of nuclear versus coal, and that this is entirely missing from the DES.

7. Scale

Scaling up of size of nuclear power plants has engendered two problems, large jumps in size without first exploring on prototypes the effects of moving well up the line on size; and the aggravation of this risk in nuclear plants as opposed to those using fossil fuel. I asked Siemens, which has made all nuclear power plants in Germany, why the non-nuclear part of the plant seemed to have more casualties than the primary nuclear circuit -- something I had observed in reviewing the individual plant data from the International Atomic Energy Agency. The answer is that since pressures and temperatures of steam in nuclear plants are a fraction of those in fossil fuel plants, the size of the equipment such as boilers and turbogenerators must be much larger, and has breached the experienced limits of scale. I give examples I have selected at random in Table 2.

This factor must be considered in a comprehensive analysis of future plant economics, but has been overlooked in the DES.

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TABLE 2: Pressures and Temperatures of Coal and Nuclear Power Plants

	COAL					NUCLEAR			
UNIT	Manatee	Wansley	Mansfield	Bull Run	Browns Ferry	Trojan	Beaver V	St. Lucie	Indian Point 3
Company	Fl PL	GaPC	PaPL	TVA	TVA	Ptlnd	PA	FlPL	PASNY
MW	863	952	914	950	1152	1216	923	850	1125
Year Built	'76	'76	'76	'67	'74	'76	'76	'76	'76
Type					BWR	PWR	PWR	PWR	PWR
Turbine:									
a. PSI	2400	3500	3500	-	950	873	735	750	715
b. OF	1000	1000	1000	-	575	533	517	513	507
c. RPM	3600	3600	3600	-	1800	1800	1800	1800	1800
Boilers:									
a. Number	1	1	1		2				
b. PSI	2500	3625	3785	3650	1005	895	781	750	
c. OF	1000	1000	1000	1003	575	533	517	513	507

Source: FPC/FERC, Statistics of Steam Electric Plants, 1976 and earlier years.

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- The effect of using domestic sources of alternatives to nuclear power on military expenditures, balance of payment pryblems and inflation due to OPEC pricing, is vital in today's context to an economic analysis of such use. Some serious attention should be given in the DES to these factors.

8. Technological constraints

There are serious questions of corrosion in nuclear power plants, including leakages from the primary into the secondary circuits. The best state of the art of welding is in question for the containment vessels. The metallurgy and welding and wall thicknesses of piping and tubing is also in question. The quality and adequacy of valving, pumps, metering etc. are also uncertain. The Germans and British, particularly, have been uneasy on these points and have commissioned extensive studies of the factors involved. The DES gives no mention of these risk factors in prediction of operation of a nuclear plant, but such mention is essential.

9. Human Factor constraints

A certain high level of quality control is essential at all levels of nuclear power manufacture, construction and operation and this depends on labor, management and design personnel, as much as on pure technology. There are serious questions of the level of human excellence in these areas in terms of quantity available, adequacy for the requirements of the sensitive nuclear technology, and willingness to work in the nuclear power industry. Three Mile Island only brought these factors to the public attention, but only more in degree than the Browns Ferry Fire. These questions go to the heart of the real world feasibility and costs of nuclear power. However, no recognition has been given to it in the DES.

10. Low sulfur Eastern coal, as alternate for Western Coal in New England

The DES is couched entirely in terms of either high sulfur Eastern coal with FGD, or low sulfur Western coal without FGD. There is another real possibility low sulfur Eastern coal. There are billions of tons of this coal. At minimum the DES should mention and evaluate this possibility.

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III. SPECIFIC COMMENTS ON DES

I now comment on specific items referring to the page in the DES. Six general comments can be made by way of the DES frame of reference.

-- It uses a strict time horizon of 1986-90. Any alternative which will not produce 2300 MW by that time is eliminated as a possible substitute for nuclear power plants. For several of the alternatives, however, their additive effect exceeds the output of at least one, possibly the two nuclear units, but this has not been considered by the DES. Also, there is substantial evidence that there is conventional non-nuclear fossil fuel supply oil, coal hydro which, with a reasonable degree of conservation, will carry us through a 50 year time horizon. Therefore, it is not necessary to posit nuclear plants for 1990 if other costs, such as risks and radioactivity are considered primary. I am not advocating that position here, but making the point that it should have been given some recognition in the time frame of the DES.

-- The DES bases its economic analysis on a 60% + 10% capacity factor. Operation and maintenance costs are then keyed to this as the normal expectation in planning the nuclear capacity. There is a possible error of assumption here. If the company ordering the nuclear plant assumes a higher CF, and bases its power supply planning on that assumption, then any serious shortfall requires it to purchase power to replace the deficit. The cost of purchased power is very high because it generally is from older and less efficient fossil fuel plants. This is the case at hand. NEP assumes a 74% CF. The shortfall when 60% is achieved, or 50 to 55%, engenders two expenses not included in the DES staff analysis: purchased power, and high costs of repairing the casualties or other defects which cause the

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shortfall. On this ground, the DES analysis is seriously defective. If corrections are made for purchased power and maintenance, the excess of 15% for coal generating costs over nuclear costs estimated by the staff at 60% CF (at p. 9-27) more than disappears, and on these two points alone coal becomes cheaper.

-- The DES assumes that coal and nuclear will be paired at the same CFs. This is an error. Nuclear power must be treated as close to run-of-stream hydro, therefore used whenever available (with few exceptions). Coal is load following and will be shut down in regions such as upstate NY (where the Niagara and St. Lawrence hydroelectric projects, run-of-stream, supply half the energy) whenever demand is less than run-of-stream supply. This will occur 11 pm to 6 am, and weekends and holidays. When considering new plants, a baseload coal plant can consistently average 75 to 85 percent, as shown by actual data of large units. The 50 to 60 percent limitation on nuclear is entirely due to technological shortfalls below the 80% design. If these shortfalls can be corrected, the costs would rise substantially for nuclear power. The DES has completely ignored the considerations in this paragraph.

-- The DES overlooks the purely fuel savings value of substituting cheap power on a non-base load arrangement in certain situations. This is due to the reversed ratio of fuel to total generating cost between 1968 and 1979. In '68 this ratio was about 40%, today it is about 60%. Therefore, substitution of Canadian power when it is available, if the rates are low enough or wind, solar and solid waste alternatives. There should be a good degree of analysis of this factor.

-- The DES is flawed in not looking at the total interrelated energy picture. For example, the high use of geothermal, solar, oil shale, etc. in other areas reduces the world and US demand for high

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marginally priced oil and other synthetic substitutes, and thus reduces the cost of, say, oil to New England. This in turn would reduce the economic value of nuclear power in comparison with coal or oil.

The NRC staff eliminates as feasible substitutions for the 2 nuclear power plants all alternatives except coal. In Table 3, I indicate, on a scale of 10 optimum, my evaluation of the adequacy of the staff analysis, and in some items my agreement with the Staff conclusion. I add specific comments below.

Power purchased from Canada: the incremental hydro unit is so large relatively to the small Canadian market, that there is advantage for the Canadian provinces to send this power to US cheaply for several years. This would affect the amount and timing of nuclear power in New England, depending on prices and estimates of future need by Canadians of their hydro. The DES needs more analysis.

Modernization, in view of the reversed fuel to total generating cost of power, should be given more attention in the DES.

Natural Gas: the DES is not aware that in the past 3 years the natural gas deficit has become a surplus, and that in New England eg, the gas companies are advertising for new customers. The DES should revise its analysis.

Solar: The DES treatment here is not too profound. For example, I use 1100 kwh a month in my house. Half is for electric hot water. If I can get 60 to 80 percent of this from solar, the drop in need for electricity is great. Even if the solar substitutes for oil or gas, the interrelated demands for fuel will affect the supply and price of oil or coal for electricity generation.

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TABLE 3: Non-Coal alternatives to Nuclear Power, Evaluation of NRC Staff Positions

Alternative & Page No.	Approx. Value MW	Adequacy of NRC Analysis 10=Optimum	My position on NRC staff rejection
9-2 Power purchase from Canada		8	agree, generally
9-2 Modernization of older fossil plants	600	4	More anal. needed
9-2 Baseloading peaking capacity		8	
9-3 Oil	0	8	
9-4 Natural Gas	0	7	Analysis too sparse and superficial
9-5 Hydro	2300	5	
9-5 Magnetohydrodynamics (MHD)		9	I agree
9-6 Fuel Cells, 1990		4	I agree with reservations
9-7 Oil Shale	2.5 MBD	5	NRC too Negative
9-7 Geothermal		8	I agree with reservations
9-8 Solid Waste, municipal	2300	6	NRC too negative
9-9 Fusion, commercial by 2,000 AD		9	agree generally
9-10 Solar		9	too negative
9-12 Photovoltaics		8	
9-13 Wind		7	
9-15 Cogeneration		7	
Total	5200		
	+ 2.5 MBD oil		

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IV. COMPARATIVE ECONOMICS OF NUCLEAR AND COAL GENERATION

As a general comment on the health effects of nuclear and coal plants, particularly coal, they are too nebulous, too little is known as yet today, to factor them into cost comparisons. I am not sure these areas are for me to comment on, in any case. (pp. 9-17 to 9-26).

My main comment will be on Appendix D on the coal-nuclear comparison. I will not repeat comments where they have already been made above.

1. No of units. The DES assumes 2 x 1150 MW nuclear units and 3 x 767 units for coal. There are already 1350 coal units, and a number at a 1,000 ±. Using 2 x 1150 for coal as well would pari passu with nuclear, reduce the relative cost of coal, and might come close to eliminating the advantage of nuclear given by NRC staff (15% at 60% CF).

2. The only mention of using Eastern coal (p. D-9) is for high sulfur coal. There are billions of tons of low sulfur coal, and this availability should have been analyzed.

3. Capital costs: the NRC comparison is of a high sulfur Eastern coal with FGD with nuclear. The investment cost ratio of coal to nuclear by Exxon's Research and Engineering Division. This private internal study was made available to me. Unlimited resources were put into the study by Exxon. It shows an investment ratio for a New England plant for nuclear and high sulfur Eastern coal of 72%. I suggest further analysis by DES of the investment factor, because the Exxon ratio would come close to wiping out the nuclear advantage of NRC staff. Furthermore, for Appalachian low sulfur coal without FGD - a possibility I have criticised the NRC study for neglecting -- its ratio is only 53%.

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4. O & M: I have already commented on this above, and need not repeat here.

V. CONCLUSION

I could submit numerous significant annotations on the DES, but have covered the more important ones.

The conclusion of my analysis of the DES is that its ommissions of coverage, and its defects of assumptions, methodologies, numbers, note of other studies such as the Exxon study, and overall coverage are so great as to require a rejection of the study as it now stands.

With investments of 3 to 5 billion dollars, a more adequate NRC study is warratned. After 28 years of commercial nuclear power in the US, it is time for NRC and/or DOE to mount and come forth with such a study.

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REVIEW

Chapter 8 - Need for Plant

Chapter 9 (9.1.1 & 9.1.2) - Alternatives

of

Draft Environmental Statement

NEP 1 & 2

NUREG-0529

May 1979

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Review of Chapter 8 and 9 (9.1.1.-9.1.2)

Draft Environmental Statement NEP 1 & 2 (NUREG-0529)

I. General

The NRC review team is to be commended for the vastly improved quality of the writing and analytical techniques employed in Chapter 8 of NUREG-0529 compared to previous impact statements read by the reviewer. The reader receives the distinct impression that no longer is the review process merely a rubber stamp procedure, rather that the various assumptions put forth by the developer are subjected to rather rigorous and objective scrutiny by the NRC staff. Yet, in spite of this improvement in the quality of the review process, it remains true that the entire process is organized as a nuclear permitting procedure. Unfortunately the review process is not organized as an optimizing procedure to determine the best socio-economic-environmental mix of fuels, plant sizes, and plant locations to meet various demand scenarios. Rather the process is constructed to review, and if necessary fine-tune, nuclear proposals only. As such the use of available information on non-nuclear power sources even between chapters 8 and 9 of the DEIS, leaves much to be desired. No mention is made of the present day efforts of the New England governors through the N.E. Regional Commission to bring in Canadian hydro power. In fact it is stated (p. 9-1 bottom) that "a mutually advantageous energy or capability diversity between the applicant and the Quebec Hydro-Electric Commission is not likely." Additionally no mention is made of the efforts or results of the New England Energy Congress (NEEC). It is of interest to note that the plan issued by NEEC was, in fact, the result of an optimizing procedure, referred to previously, which considered the best socio-economic-environmental mix of fuels, plant sizes and plant locations to meet various demand scenarios. The optimization

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of the plan was obtained by a consensus procedure encompassing the significant constituencies of the region (utility industry, environmental small business, low income, R & D, government consumer education, labor, and finance).

In summarizing these general observations it can be said that the NRC review of the Chapter 8, Need for the Plant, and Chapter 9, Alternatives, is a marked improvement over previous impact statements, but that it still suffers from a lack of integration of information from within the report itself and from plans and efforts within the region since mid-1978. Thus there are presently serious omissions in these chapters, which are addressed in more detail in the following section of this critique.

II. Specific

This section is divided into two parts, one concerned with the integration of information contained within Chapters 8 and 9, and the other concerned with the integration of information available in the region since early 1979 but not mentioned in the DEIS.

A. Integration of Information From Within the DEIS:

In Chapter 8 a schedule used by New England Electric System is reproduced (Table 8.18, p. 8-22). The only hydro-electric facilities mentioned are a series of Pumped Hydro totalling 1500 MW. These do not appear to come on-line until 2002 A.D. (300 MW in 2002; 600 MW in 2005; and, 600 MW in 2007). There is no mention of bringing these on-line sooner, and the effect that would have on the need for NEP 1 & 2.

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In Chapter 9 a series of alternatives are discussed (see p. 9-1 to 9-17). Each is discussed separately, its potential compared to projected need, and then each is rejected as being inadequate by itself to fulfill the projected need. There is no attempt to arrive at a mix of alternatives in order to assess their potential as a group for supplying power to the region. The only alternative source discussed in Chapter 8 is residential active solar (p. 8-8) and that is based on a 1976 Mitre Corp. study comparing solar with electrical resistence and heat pump systems for space heating. On the other hand, Chapter 9 residential active solar is given rudimentary treatment (p. 9-12) and space heating is aggregated with domestic hot water in an unclear manner. Electrical heating of domestic hot water is nowhere segregated and analyzed. Passive solar is not mentioned.

The following table has been constructed from the quantified information provided in Chapters 8 and 9 and indicates one estimate of alternate sources, based on the integration of data used by NRC staff in the two chapters.

Alternate Source	(DEIS reference page)	Capacity-MWe
Pumped Hydro	8-22	1500 MW
Hydro-Quebec	9-1	1200
Upgrade Older Plants	9-2	560
Upgrade Existing Hydro	9-5	2300
Municipal Solid Waste	9-9	1000
	Total	6560 MWe

The impact of rescheduling proposed additions to capacity and of including capacity from non-nuclear fuel sources must be considered by NRC staff in their review of the application for NEP 1 & 2.

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B. Integration of Information from the New England Region:

1. A detailed strategy for cutting New England's dependence on foreign oil was announced June 11, 1979 by the 25 members of the New England Congressional Caucus. The plan was the product of over a year's work by the 120 members of the New England Energy Congress (NEEC) which represented the twelve significant constituencies of the region. The 500 page "New England Blueprint for Energy Action" and a package of 25 bills being introduced in the U.S. House of Representatives were the result of a "first in the nation" effort to develop a regional energy plan.

Some of the findings from this concerted effort were :

- from 1965-75 the demand for energy in New England grew at an annual rate of 1.8% per year
- with the conservation programs now in place the growth rate was predicted to be 1.5% between 1978 and 1985.
- if a major commitment to conserve energy is made the rate can be reduced even further.
- 25% of New England's energy needs can be met in the year 2000 by the region's own renewable sources: wood, solid waste, hydro, solar, etc.
- natural gas can be increased from the current 8% to 13% of energy needs by the year 2000.
- coal, in contrast to other regions, will likely play a relatively minor role, and provide 5-6% of the total This could change if Narragansett Basin reserves are proven and can be extracted economically.

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- oil which will still be the largest source of supply in 2000 can be reduced from the current 80% to under 50% of total energy supply.
- nuclear will provide about 10%. This will require an additional 3450 MWe of capacity by 2000.

The following table has been excerpted from that report (p. 41 Table 8) to yield an estimate of the contribution that a mix of regional renewable sources can make to the generation of electricity

Regional Renewable Resource - 10^9 kwh/year -

	1978	1985	2000
Wood	0.8	1.7	9.5
Municipal Solid Waste	0.2	0.8	4.6
Tidal	0	0.04	1.8
Hydro	5.7	6.9	11.1
Wind	0	0.4	4.8
Photovoltairs	0	0	12.0
Peat	0	0.2	4.8
	6.7	10.0	48.6
Equivalent Capacity (0.6 capacity factor)	1275MW	1900 MW	9200 MW

Of note is that the 1200 MW from Hydro Quebec is not included in the New England regional resource estimate.

2. Since the writing of the NRC staff review of NEP1 & 2 additional socio-economic information is available regarding the future supply of electricity to the New England region.

In June 1979 the governors of Rhode Island, New Hampshire and Vermont made direct contact with Quebec premier Rene Levesque concerning the purchase of Canadian hydro. This committee acted through

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the Northeast International Committee of Energy an arm of the New England Regional Commission. Subsequent to the committee's contact with Premier Levesque, Governor Garrahy of Rhode Island met with him in Quebec, and is expected to meet with him again in Providence. Public utility commission chairmen of the three states have discussed in tentative terms the formation of a New England public power authority to enter into negotiations for Canadian electricity. With the political pressure growing, NEPOOL has authorized six top executives to discuss these possibilities with the premier. It has been stated (15 July Boston Globe) that utility company planners believe a transmission line capable of carrying a minimum of 750 MW is needed to make any hook-up economically feasible. Construction of such a line is estimated to cost $200 million and require two years. LaGrande-2, the first of three large dams nearing completion in the vicinity of James Bay, will be put into service in October, and as early as the summer of 1980 up to 1000 MW will be available for export from Canada. By the mid-1980's when the entire project is completed the surplus for sale each summer could equal 6000 MW.

3. The feasibility of large capital intensive projects such as NEP 1 & 2, in times of uncertainty, such as those of today, is under rigorous scrutiny. From a planning standpoint if the future is unclear it is often best to take small steps. If the rate of growth of demand for electricity has changed from 5-7% per year to 1-3% it seems wise to add capacity in smaller increments in order to maintain flexibility and subject the investment to less risk. It is also true that smaller additions to generating capacity, when using non-nuclear fuels

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in particular, can be located closer to load centers, thereby reducing transmission line losses as well as providing opportunities for cogeneration. The financial community, or the source of funds for NEP 1 & 2, abhors uncertainty. From their viewpoint today's uncontrollable inflation coupled with unknowns in the wake of Three Mile Island make a project such as NEP 1 & 2 unattractive. On 21 June 1979 in Providence, a spokesman for Kidder, Peabody & Co., a major Wall Street firm, said at an investment seminar "We think the nuclear power industry is dead and it may be dead forever". The spokesman went on to say, "there isn't a board of directors of any public utilit, company in the country that is going to undertake a nuclear plant".

The impact of non-utility energy planning and of socio-economic decisions pertinent to the region must be considered by NRC staff in their review of the application for NEP 1 & 2.

C. Conclusion

It is apparent that the rather substantial socio-political forces at work in the region have been largely ignored, or at least overlooked by the NRC staff in their review of the NEP 1 & 2 proposal. Some of these have been discussed in this critique. According to the Council on Environmental Quality (CEQ) guidelines on content of environmental statements, especially Section 1500.8 (a) (3), (4) and (5), these factors must be adequately addressed.

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Preliminary

REVIEW OF CHAPTER 8
AND
SECTIONS 10.4 AND 10.5 OF THE NEP 1 & 2 DES

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The central elements in the impact study's assessment of both the need for and the benefits associated with the construction and operation of New England Power Units 1 and 2 are projections of electricity generating capacity and consumption. The analysis of supply is straightforward and needs no comment. Projections of supply simply involve an inventory of the existing plant capacities and planned additions.

A review of the demand forecasts, however, reveals some potential problems. NERA, ORNL, and staff have all used econometric forecasting to determine the need for electric power.

Econometric forecasting is often extremely sensitive to underlying assumptions. The price-sensitivity analysis and the section on forecast comparisons are both quite interesting and point out the dependency on assumptions. The report treats assumptions individually rather than combining them. It would be considerably more informative if scenarios were developed that changed a variety of assumptions simultaneously. For example, a "worst case" might be a combination of successful conservation, high price, and slow regional growth. It would also be interesting to see what set of assumptions (if any) will make the ORNL model produce the NERA results.

The projections of energy consumption formulated by the staff and by NERA that appear in Table 8-11 indicate that there is considerable disagreement on the growth in demand. The "Comparison of Forecasts" Section attempts to identify the factors responsible for this disagreement, but the reader is left with the distinct impression that all forecasts are meaningless. The validity of the forecasts could be better seen if a variety of scenarios were presented with each model and the results plotted out in the same graph.

The benefit-cost summary presented in Sections 10.4 and 10.5 generally suffers form a lack of careful consideration of alternatives. Including both employment and taxes as benefits is simply not proper unless one is aware of the alternatives. The section is simply a summary of the rest of the volume. Although it is organized as a cost-benefit analysis, it is not, from an economist's perspective, a cost-benefit analysis.

Specific Comments

1. It is impossible to compare the NERA, ORNL, and staff models. These models should be presented in an appendix.

2. The wide variation of parameter estimates reported in Section 8 are dificult to interpret without any information on statistical significance.

3. Section 8.2.3 discusses the substitution of new technologies. While it dispenses with solar as uneconomic, it also indicates that the heat pump is an attractive alternative. How does the forecast change if the growth of electricity demand for heating is based on the heat pump rather than resistance heating? This seems to be ignored in the forecast.

4. Section 8.2.5 indicates a dramatic reduction in demand through mandatory conservation, yet this possibility is totally ignored in the forecast.

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5. Much of the increase in residential demand is based on electric heat users. Section 8.2.1.1 is confusing. The forecasts of new electric heat customers seems widely divergent. What is the staff estimate, and how was it derived?

6. Both population and residential customers are included as determinants of commercial demand. While the role of population is clear, the independent role of residential customers is not. I would certainly expect disastrous multicollinearity in any estimation attempt.

7. Estimation of the parameters of the staff model used 1955-1974 data. It is difficult to believe there has not been a significant structural shift in energy consumption since 1973. How does the model track from 1975-1979?

8. How were the values of the economic and demographic variables "inputted" to the model obtained? How sensitive are the results to forecast errors of these exogenous variables?

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