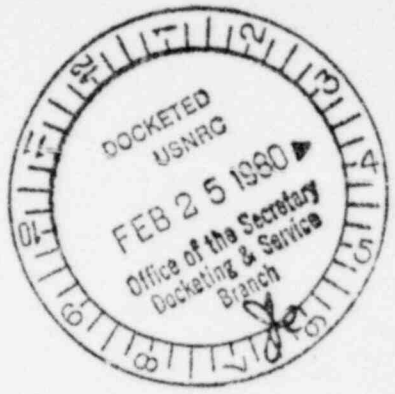

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

THE ATOMIC SAFETY AND LICENSING BOARD

Elizabeth S. Bowers, Chairman
Dr. Walter H. Jordan, Member
Dr. Donald P. de Sylva, Member

In the Matter of	)	
	)	Docket Nos. STN 50-488
DUKE POWER COMPANY	)	STN 50-489
	)	STN 50-490
(Perkins Nuclear Station, Units 1, 2 and 3)	)	

SERVED FEB 26 1980

PARTIAL INITIAL DECISION

(Construction Permit Proceeding)

(February 22, 1980)

Two Partial Initial Decisions, LBP-78-25, 8 NRC 87 (July 14, 1978) and LBP-78-34, 8 NRC 470 (October 27, 1978), were issued in this proceeding. The first one pertained to Radon-222 and the second one pertained to all issues except alternate sites and generic safety issues. This Partial Initial Decision ratifies our previous Partial Initial Decisions and determines the alternate site issue.

Alternate Sites

Background

1. In the environmental hearings in 1977, the Board questioned on April 28, 1977, whether the record was adequate as to "alternate sites," in view of Florida Power & Light Company (St. Lucie Nuclear Power Plant, Unit No. 2), ALAB-335, 3 NRC 830 (1976), which remanded the issue to the Licensing Board. (Tr. 1482, 1488, 1581-1630, 1650-1657). A second decision was issued on

October 7, 1977, on the alternate site issue in St. Lucie, by the Appeal Board; ALAB-435, 6 NRC 541 (1977).

2. On April 5, 1978, the Board issued an Order which stated, inter alia:

> "The responsibility of the Staff in its evaluation of alternate sites was considered by the Appeal Board in St. Lucie. We think it appropriate for the parties to provide the Board with short statements in the form of citations to the record and comments on the law as to their perceptions of the state of the record in this proceeding in that regard. [footnote omitted]."

In response thereto, both the NRC Staff and Applicant maintained that the record reflected the adequacy of the Staff's consideration of alternative sites, consistent with the National Environmental Policy Act (NEPA) and NRC case law. See responses of Staff and Applicant, dated April 17 and April 21, 1978, respectively. Intervenors contended that the consideration of alternative sites by the Staff and by the Licensing Board had been insufficient, specifically in the failure to evaluate the possibility of locating a nuclear facility on Lake Norman using once-through cooling (i.e., discharge of heated effluent directly into the receiving basin). See Intervenors' Response, dated April 21, 1978.

3. Prior to this Board's ruling on the adequacy of the record in regard to alternative sites, the Appeal Board issued decisions on April 28, 1978 and May 25, 1978, which addressed the adequacy of NRC Staff review of alternative sites. [1/] Without

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1/ Public Service of New Hampshire, et al. (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 477 (1978) and Boston Edison Co. (Pilgrim Nuclear Generating Station, Unit 2), ALAB-479, 7 NRC 774 (1978).

further explanation, the Staff, on June 15, 1978, moved to reopen the proceeding to take additional evidence on Staff review of alternative sites. Applicant vigorously opposed the motion, stressing that the Staff review in Perkins had been fully consistent with the above-referenced Appeal Board decisions. See Applicant's Opposition, p. 4, line 8, and p.5, line 5, dated June 27, 1978. Intervenors supported the Staff motion. See Intervenors' Response, dated June 29, 1978. On July 14, 1978, this Board granted the Staff's motion and reopened the record for the limited purpose of taking new evidence "regarding the Staff's analysis of sites alternate to the Perkins site." The parties proceeded with discovery, and evidentiary hearings were held January 29, through February 2, 1979, on the issue. At the hearing the following exhibits were admitted into evidence:

Summary Report, Jan. 1978, Duke Power Co., Site Studies, Feb. 1978, Duke Power Co. Response to NRC Request for Additional Info., Aug. 18, 1978.	- Staff's Exhibit 10 (Tr. 3061)
August 7 Response of Applicant	- Staff's Amended Exhibit 10 (Tr. 3078)
(Plant Site Evaluation Using Numerical Ratings)	- Intervenors' Exhibit 7 (Tr. 3656)

Evidentiary Hearings

4. Consistent with the purpose of the reopened hearing, the Staff presented a panel of witnesses, all of whom were adjudged to be experienced in appraisals of potential environmental impacts and alternate sites. (Professional Qualifications attached to

Supplementary NRC Staff Testimony, following Tr. 3049; Tr. 2988, 3046-48, 3069). This panel presented two pieces of evidence--the Supplementary NRC Staff Testimony (incorporated in the record following Tr. 3049) and Applicant's responses to Staff questions, which were part of the basic data upon which NRC premised its analysis.[2] (Staff Exhibit 10 admitted at Tr. 3061 and Supplemented at Tr. 3078).

5. Applicant's responses to a series of Staff questions were made on August 8,[3] 31, and September 27, 1978. (Tr. 3078-79). These responses documented Applicant's site-selection process which leads to its selection of the Perkins site. Applicant describes its methodology addresses the screening and selection process, including criteria for site elimination and selection, provides the underlying data upon which Applicant premised its site evaluation, and identifies potentially licensable sites for power-generating facilities in and about Applicant's service area. Because Applicant's responses form the background for the Staff review, as well as the analysis presented by Intervenor's witness, Dr. Alan Lipkin, the Board deems it prudent to explore them in some detail.

2/ While the Staff presented Applicant's responses, Applicant subsequently affirmed that such were performed in the regular course of business and were true and correct. (Tr. 3652-53)

3/ Applicant's August 8, 1978, response consisted of a cover letter of that date and actual responses dated August 7, 1978. Both dates have been used interchangeably throughout the record. It should be noted that this response included Applicant's X-81 and X-82 Site Studies, February 1973 and Phase-I Siting Study, January 1979, both of which have been separately referred to throughout the record.

6. The responses address Applicant's original alternative siting analyses, as set forth in its X-81 and X-82 Site Studies, February, 1973. They explain that the Perkins site was selected in April 1973 based upon studies performed in the latter half of 1972 and early 1973. (Applicant's August 7, 1978 Response at p. 1, Staff Exhibit 10). Since Applicant had previously purchased both fossil and nuclear units in the range of 1100+ MWe, it was decided that an optimum plan, considering the economics of standardization, would be to purchase six identical units of the 1200-MWe class. Based upon studies of Applicant's Catawba Nuclear Station, Applicant had previously decided that nuclear power would be the most economical and environmentally acceptable. Accordingly, Applicant's site selection process tried to select the two best sites for nuclear units. Applicant also knew that the 1972 Federal Water Pollution Control Act (FWPCA), as amended, [4/] would lead to new promulgation of regulations by the Environmental Protection Agency (EPA) concerning alternate methods for heat dissipation from steam power plants. Because EPA regulations had yet to be promulgated, Applicant did not want to use cooling towers when lake cooling might be an alternative, or to select sites on existing or new lakes when regulations might require cooling towers. Thus, Applicant was seeking nuclear generation sites suitable for either once-through lake cooling or using cooling towers. (Applicant's X-81 and X-82 Site Studies, February 1973, and August 8, 1978 Response at pp. 1-12, Staff Exhibit 10).

4/ 33 U.S.C. § 1251 et seq.

7. An initial review by Applicant of Applicant's region of interest, i.e., the Duke Power Company service area and the immediately adjacent areas, was performed using Applicant's inventory of sites. Preliminary screening located additional site areas. Primary screening was then conducted. Applicant considered such engineering and environmental factors as water availability, access to the existing transmission network, institutional factors, and the location of other sites. This review and screening eventually led to the analysis of nine sites and a variety of sites with suitable condenser-cooling alternatives. Reconnaissance-level information was evaluated and the comparative costs to begin construction at each site was evaluated. Water-use studies, transmission system studies, and conclusions and decisions regarding waste heat dissipation led to the selection of the Perkins site for one of the two plant sites as described in Applicant's Construction Permit Application submitted in March, 1974. (Applicant's X-81 and X-82 Site Studies, February 1973, and August 8, 1978 Response at pp. 1-12, Staff Exhibit 10).

8. The Applicant's responses also reflect that in mid-1976 Applicant initiated a thermal station siting program, the preliminary result of which was the Summary Report Phase-I Siting Study, January 1978. The program was independent of Perkins. Its objective was to select the two best fossil and the two best nuclear-site alternatives for the baseload generation needs in the period after the commercial operation of the Perkins units. The Study was designed to complement existing siting guidelines and

regulations. It used a systematic screening methodology, similar to methods outlined in NRC Regulatory Guides 4.2 and 4.7; it recognized the exclusion of areas based on reconnaissance-level information; and it made conservative site-selections based on objective quantitative and subjective qualitative evaluations. (Applicant's Phase-I Siting Study, Staff Exhibit 10).

9. A"coarse screening" of the region of interest identified potential areas and candidate areas. The coarse-screening process examined general engineering and environmental criteria associated with water availability, land use, transmission facilities, geology, seismology, demography, and meteorology. Based upon the Study, 100 sites were identified for further evaluation. (Applicant's Phase-I Siting Study, pp. 3-5, August 8, 1978 Response, Attachment 2 and August 31, 1978 Response at pp. 3-1 through 3-9 and Table 3-1, Staff Exhibit 10).

10. The Applicant's intermediate-screening of candidate areas resulted in the identification of "site areas" and "potential sites". Applicant used large-scale mapping to indicate potential sites. Such sites then lacked formal evaluation. Each site was further evaluated based upon visits and more detailed analysis of reconnaissance-level data. This process excluded 62 sites from the original 100; the remaining 38 sites are evaluated and presented in the Phase-I Siting Study. The 62 sites were excluded because:

a. 18 were located in areas classified as natural and scenic, or state park or national forest. Several were distant from the Duke service area.

b. 12 had insufficient land or water to support 2600-MWe thermal stations.

c. 2 are presently power-plant sites (Catawba and McGuire).

d. 1 was inundated by an existing project (Lake Norman).

e. 7 reflected commercial and industrial buildup.

f. 7 duplicated sites carried into the Phase-I study as potential sites.

g. 11 were geologically (seismically) undesirable.

h. 3 are possible fossil sites adjacent to existing fossil stations.

i. 1 has been developed by a muncipality for water supply.

(Applicant's Phase-I Siting Study at pp. 5 and 6, August 8, 1978 Response, Attachment 2 and August 31, 1978 Response at pp. 3-1 through 3-9, Staff Exhibit 10).

11. The 38 identified sites then were further evaluated by Applicant during the fine-screening phase. The fine-screening process excludes potential sites based on a more detailed evaluation of criteria related to the cooling-system development, environmental impacts, transmission, flood hydrology, transportation, population density, meteorology, and other engineering and environmental considerations of each site. Applicant provided

detailed information on each criterion. (Applicant's Phase-I Siting Study at pp. 8-11 and August 31, 1978 Response at pp. 1-2 through 1-7, Staff Exhibit 10). Utilizing a mathematical matrix, the information gathered for each criterion for each site was translated into either a cost factor or a numerical rating factor. The rating factor is a numerical value or value range treated consistently for each potential site. Applicant provided a detailed description of its rating process. Applicant's Phase-I Siting Study, Attachments 1-5, Staff Exhibit 10). Each criterion, exclusive of the measurable costs, was also assigned a weighting factor. The weighting factor indicates the relative importance assigned by the Applicant to each listed criterion; the higher the weighting factor the more important the parameter is considered to be. Applicant explained the weight assigned each criterion. (Applicant's August 31, 1978 Response pp. 1-2 through 1-7 and Phase-I Siting Study at pp. 7-8, Staff Exhibit 10). The rating factor multiplied by the weighting factor for each criterion, added to the products, resulted in a weighted total (termed Site Quality) for each alternative. The criteria evaluated based on costs were totaled to yield a dollar penalty ($ penalty). The Site Quality number and a dollar penalty number have been determined for each plant-site alternative; the higher the Site Quality and the lower the dollar penalty, the better the plant-site alternative. (Applicant's Phase-I Siting Study at pp. 6-8, Staff Exhibit 10). For clarity, a matrix format is set forth on page 12.

12. Through a review of total Site Quality points and site dollar penalties, the 38 sites were analyzed to select the ten best sites which would be representative of cooling and fuel alternatives. (See Applicant's August 31, 1978 Response, pp. 6-5 through 6-25, Staff Exhibit 10, for information used in this analysis; see Phase-I Siting Study, Table 6, for a list of the ten selected sites, which are designated under the "Sites to Carry Forward" column by an asterisk, Staff Exhibit 10).

13. Because the 38 sites reflected in the Siting Study were not limited to the nuclear option only, the Staff requested additional information related to the 4000-MWe nuclear sites using the cooling tower option. Applicant's preliminary evaluations of the 38 sites indicated that only 27 were suitable. Applicant explained the reasons for exclusion of the eleven sites. (August 31, 1978 Response at pp. 6-2 through 6-5). After preliminary review, an additional four sites were excluded because they had a total Site Quality point value of less than 100. (August 31, 1978 Response at pp. 6-5 and 6-25). A minimum streamflow of 500 cfs was adopted as the minimum streamflow necessary for radwaste dilution for the 4000-MWe nuclear alternative, and this consideration ruled out six sites. (August 31, 1978 Response, p. 6-25).

14. The remaining 17 sites were further evaluated by Applicant; some were eliminated because they were not significantly different alternatives. For example, if two sites were located near each other on the same water body, only the better one was

chosen. With this further elimination, eight sites were selected (a description of Applicant's evaluation is set forth in its August 31, 1978 Response, pp. 6-25 through 6-28). The process of fine-screening and evaluation produced the subsequent 4000-MWe nuclear/cooling tower candidate sites:

1. Lake Norman "E"
2. Lake Hartwell
3. Tuckertown
4. Fishing Creek Reservoir
5. Broad
6. Middleton Shoals
7. Clinchfield
8. Wateree

SITE EVALUATION CRITERIA

CRITERIA	Weighting	±2600 Nuclear Towers	±2600 Nuclear Lake	±2600 Fossil Towers	±2600 Fossil Lake	±4000 Nuclear Towers	±4000 Nuclear Lake	±4000 Fossil Towers	±4000 Fossil Lake
I. COOLING SYSTEM DEVELOPMENT									
a. Water Availability During Low Flow	3								
b. Thermal Effects	3								
c. Reduction of Stream Flow	3								
d. System Costs	$								
II. ENVIRONMENTAL IMPACT									
a. Endangered Species	3								
b. Existing Aquatic Recreation	1								
c. Existing Terrestrial Recreation	1								
d. Potential Aquatic Recreation	2								
e. Potential Terrestrial Recreation	2								
f. Water Shortage Area	3								
g. Pollution	2								
h. Minerals	1								
II. TRANSMISSION									
a. Proximity and Capability	$								
b. Penalties	$								
IV. FLOOD HYDROLOGY	2								
V. ACCESSIBILITY									
a. To Rail	$								
b. To Highway	1								
VI. POPULATION DENSITY	2								
VII. OTHER CONSIDERATIONS									
a. Earthwork	$								
b. Seismology	1								
c. Relocation	1								
d. Duke Land Holdings	$								
III. METEOROLOGY	$								
$ PENALTY									
SITE QUALITY (TOTAL)									

15. To assist the Staff in comparing Perkins with the sites evaluated in the Phase-I Siting Study, Applicant, pursuant to Staff request, furnished a matrix of the Perkins site. (Applicant's August 8, 1978 Response, Staff Exhibit 10). Applicant's evaluation of Perkins and the above-identified sites led it to conclude that there was no site obviously superior to Perkins. (Applicant's August 8, 1978 Response, p. 2 and Attachment 2, p. 2, Staff Exhibit 10).

16. The Board sought an explanation to the Staff statement (Supplementary NRC Staff Testimony at p. 6, following Tr. 3049, hereinafter referred as "Staff Testimony") regarding the "unique independence" of Applicant's Phase-I Siting Study. The Staff explained that the Siting Study assumed Perkins had obtained the necessary licenses and thus was no longer a candidate site to be considered in future site planning. Under such a circumstance, there was no opportunity to favor the Phase-I Siting Study toward Perkins. In addition, the Staff explained that the Siting Study was published in January 1978, well before the Staff moved to reopen this proceeding. Accordingly, the Phase-I Siting Study could not have attempted to downgrade sites so that Perkins would be preferable. (Tr. 3194-97).

17. We also inquired whether Lake Norman is environmentally preferable than Perkins as a result of upstream regulation of water flows. (Tr.3671-72). Applicant responded that while the Catawba River is regulated, the construction of Carter Creek Reservoir will similarly regulate the Yadkin River during low flows so that downstream effects will be minimal, as indicated by the extensive studies

previously received as evidence. 5/ (Tr. 3672-73).

18. We inquired as to the environmental effects at Perkins when flow was just above the 1000 cfs mark. (Tr. 3673-74). Applicant acknowledged that there will be some effect at that level, but that to assess the matter properly, extensive studies had been undertaken. These studies are part of this record, which show that the effect will be minimal. (Tr. 3674). Staff had earlier testified that Perkins would have a virtually insignificant effect upon the Yadkin River and High Rock Lake. (Tr. 3189). Applicant further stated that 1000 cfs streamflows are exceeded 97% of the time; and that 1100 cfs streamflows are exceeded 96.2% of the time, which means that the Board's concern is directed to a situation which will occur 8/10 of 1% of the time. (Tr. 3725). Applicant maintained that this was an insignificant amount, particularly when compared to other sites. Perkins will evaporate 2.4% of the average streamflow of the Yadkin; when and if it were located on the Catawba, at Lake Norman, it would evaporate 2.9% of the average streamflow. (Tr. 3736).

19. Applicant provided some additional reasons why the plant should be located at the Perkins site. Applicant believes that there should be a reasonable relationship of consumptive water use in the five major river basins within its service area. (Tr. 3741).

5/ For a discussion of Carter Creek Reservoir and its operation during low flows, see the Board' October 27, 1978 Partial Initial Decision, LBP-78-34, 8 NRC 470, (1978) pp. 475, 476.

These reasonable relationships should consider the number of people within a drainage basin area, the average flow in the area, the 7_Q10 flow, and the amount of water consumed to support thermal power. (Tr. 3675). In comparing the Catawba and Yadkin river basins, Applicant has calculated an index of megawatts (planned or installed) per unit of 7_Q10 flow; Catawba has 12.1 MWe per cfs based on the 7_Q10 flow and the Yadkin has 4.9 MWe. (Tr. 3675-3678). The Board viewed this index as demonstrating that there are less than half as many megawatts on the Yadkin per unit of 7_Q10 flow as on the Catawba. (Tr. 3677). Applicant has compared the water evaporated (cfs) per million people in the river basin due to Duke Power operation. On the Catawba the figure is 76.7; on the Yadkin it is 68.5 with Perkins. (Tr. 3742). Without Perkins, the Yadkin figure is 5.6. (Tr. 3742). Applicant evaluated it power-plant capacity in megawatts per square mile of a river's drainage area. (Tr. 3743). Catawba is 1.8; on the Yadkin it is 0.7, including Perkins. (Tr. 3743).

20. Under questioning, Applicant indicated that there were existing and planned facilities on Lake Norman, and that good engineering judgment requires that further siting on Lake Norman should await the outcome of planned studies which will evaluate the interaction of the facilities--such studies will not be completed until at least 1983. (Tr. 3679-80; see also Tr. 1590, 1595, 1653, 1688, 1700, 1732).

21. We asked the Applicant's opinion regarding an FES statement that if further water needs grow significantly, critical

water shortages could develop. (FES § 5.2.1.3; Tr. 3739). Applicant took issue with the FES statement and referred to the State's determination that consumption of water by Perkins was consistent with the projected future water needs. (Tr. 3739). Applicant stated that the State can impose requirements giving the State the authority to require permits for those who withdraw water. However, to require this permit the State must first declare the area as a "capacity use area". After significant State inquiries and exhaustive analysis and after consideration of potential future water uses in the basin, the State determined that it was unnecessary to declare the Yadkin River basin a capacity use area. In its determination the State assumed that the Perkins Plant would be constructed at the Perkins site. The State determination was made only after an exhaustive study and public hearings conducted by the State of North Carolina. Applicant indicated that the State had also performed an analysis on the entire water system of the State which is set forth in the North Carolina Water Resources Framework Study, 1977 (Framework Study). (State Exhibit 2). In this analysis the State placed great emphasis on future water use and specifically recommended the development of wet industry downstream in the Yadkin basin. The recommendation was made considering the Perkins Station as operating. (Tr. 3835-40). Applicant explained its consideration of future water use with regard to alternate sites. (Tr. 3740-41). Applicant explained that its Phase-I Siting Study utilized the future water use information contained in the Framework Study. (Tr. 3740).

This information is evaluated in Criterion IIf, entitled "Water Shortage Area". (See matrix at p. 12 supra). This criterion was assigned a weighting factor of 3, indicating that it was most important. Further, Applicant recognized the potential growth in municipal and industrial water use. (Tr. 3834). Specifically, Applicant considered reductions in steamflows and examined the percent reduction that a Perkins-type plant would have on such flows. This recognition is set forth in Criterion Ic, entitled "Reduction of Streamflow". (Tr. 3834). A low percentage reduction indicates a greater availability of water for future users, and thus a site with a low percentage streamflow reduction figure would be given a high rating. (Applicant's Phase-I Siting Study, Attachment 5, Staff Exhibit 10). As the "Water Shortage Area" criterion, "Reduction of Streamflow" received a weighting of 3. (See matrix at p. 12, supra).

22. The Staff testified that it independently assessed Applicant's information. First, it critically examined the screening methodology and candidate site selection process employed by Applicant. The Staff directed its initial attention to the Applicant's coarse-screening process, which evaluates Applicant's region of interest to identify potential areas and candidate areas. The Staff examined the criteria used and found the approach reasonable except for the exclusion of areas on the basis of population density within a 5-mile radius of the potential site. Applicant used a population density level of greater than approximately

400 persons per square mile as an excluder. [6/] The Staff determined this to be too conservative; however, the Staff found that the areas thus excluded were minor in comparison to the total area of the region of interest examined and were typical of areas considered (except for population level). On this basis, the Staff considered such exclusion as only a minor discrepancy in the coarse-screening process which resulted in the selection of 100 sites. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 3-4).

23. The Staff next evaluated Applicant's intermediate screening of candidate areas; this procedure screens candidate areas to identify site areas and potential sites. Utilizing this process, Applicant excluded 62 sites. The Staff examined the above exclusion criteria for these 62 sites and agreed with them except in two respects. The Phase-I Siting Study had as its objective the identification of thermal energy sites (both nuclear and fossil) rather than just nuclear sites. Such an approach could have eliminated a potential nuclear site when the procedure eliminated a site as unsuitable for a fossil plant. The Applicant has not, however, used the unsuitability of any given site for fossil as a means of eliminating any of the 62 sites as a nuclear site. Therefore, the Staff did not consider this to be a flaw in the process. The Applicant also excluded several sites in the 100 originally in the site bank primarily because of the distance from the Duke service area. If the number of sites examined had been

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6/ The Board believes that population density near a proposed site is a most important consideration and commends the Applicant's exclusion of sites with a surrounding population density greater than 400 persons per square mile.

small or if the Applicant had not examined such a relatively large region of interest, the Staff would consider such exclusion a flaw in the process. However, since the above is not true, the flaw, if it indeed exists, was considered minor. Finally, the Staff examined the geographical distribution of the 38 remaining potential sites. Therefore, the Staff concluded that the resulting 38 sites were representative of all the resource areas in the region of interest. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 4-5a).

24. The Staff then focused upon the data presented in Applicant's Phase-I Siting Study with respect to the 38 potential sites. The Staff recognized that the Siting Study was carried out to produce a preliminary decision document for use by the Applicant for choosing future sites, both fossil and nuclear. However, the Staff found that Applicant's analysis might have considered the 4000-MWe nuclear station with cooling towers, as well as other options. Accordingly, the final screening criteria used to analyze the remaining 38 sites became the subject of Staff's review of the 4000-MWe nuclear stations with cooling tower option. (Supplementary NRC Staff Testimony following Tr. 3049, at p. 8; Applicant's Phase-I Siting Study, Table 3, Staff Exhibit 10).

25. In its examination of the fine-screening criteria used by Applicant to reduce the 38 sites to a manageable number, Staff concluded that two main defects existed in Applicant's rating process. First, there was no rating factor given for land use. The Staff believed that land-use characteristics are extremely important in evaluating environmental impacts. Second, the Staff

attached no weight to the land holdings of the Applicant as a criterion to reject or accept any particular site. However, Staff believed that consideration of land usage might have eliminated some sites that were indeed retained. Thus, the lack of such data may have left more sites for Staff to examine. Except for the above caveats, the Staff agreed that the remaining rating factors were reasonable. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 6-7).

26. The rating factors were used in conjunction with weighting factors. Except for the weighting factor for seismology (which Applicant ranked as 1), the Staff agreed that the weighting factors were reasonable. Although the effects of seismic activity can be "designed for" at an increased cost to the Applicant, the Staff believed that, with the large area available to the Applicant for siting, this penalty should not be imposed on the ratepayers, and that seismological considerations should be given a weighting factor of 3. (Supplementary NRC Staff Testimony following Tr. 3049, at p. 7).

27. The Staff emphasized that all dollar costs discussed in the Siting Study had not been ranked by the Staff as the sole, primary criterion for site selection. Environmental and site-suitability factors were the initial parameters considered by the Staff in its review of the siting study. (Supplementary NRC Staff Testimony following Tr. 3049, at p. 7).

28. Information provided by Applicant and the Staff's subsequent independent evaluation was based on reconnaissance-level information. It does not include information that can only be obtained by detailed site-monitoring programs or studies such as those available for Perkins. (Staff Testimony pp. 2 and 3).

29. Based on the above, the Staff concluded that:

a. The Applicant's methodology is (1) reasonable, (2) likely to disclose potentially licensable sites, ranked in order of importance, and (3) likely to disclose a site "obviously superior" to the Perkins site, if there is indeed such a site.

b. The Siting Study and additional information (Staff Exhibit 10) are valid criteria to determine candidate sites for 4000-MWe nuclear stations to serve the Applicant's needs.

c. The only cooling option available to the Applicant at this time is closed cycle (i.e., cooling towers). This has been confirmed by Staff consultation with the State of North Carolina, which assures the Staff that the State will not license once-through cooling due to its greater heat discharge into receiving State waters. (see Reference 1 to NRC Staff Testimony).

d. The Staff disagrees with Applicant that sites on reservoirs should not be controlled by third parties.

e. The eight candidate sites listed in Table 6 of

the Siting Study as capable of supporting a 4000-MWe nuclear station with cooling towers are all viable and potentially licensable sites. The Staff rejected the Applicant's reasons for eliminating two of these eight sites. (Table 6 of the Siting Study, footnotes 4 and 6). It is obvious to the Staff, upon closer examination of the Siting Study, that a second site on Lake Hartwell should be included in the list of Table 6 of that study. This is the Lower Hartwell site. It is in Table 3 of the Siting Study as a potential site but was not in Table 6.

f. A visit to these nine sites and the Perkins site was made by Staff personnel qualified to evaluate, on a reconnaissance level, land-use characteristics, potential aquatic effects, and water-use effects. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 8-9).

30. The final sites selected by the Staff for alternative site comparisons were:

	SITE	IDENTIFICATION CODE
1.	Fishing Creek Reservoir	250612
2.	Lake Norman "E"	150512
3.	Wateree	250812
4.	Clinchfield	160102
5.	Broad	160302
6.	Middleton Shoals	280312
7.	Hartwell-LaFrance	280512
8.	Lower Hartwell	280612
9.	Tuckertown	140612
10.	Perkins	(Supplementary NRC Staff Testimony following Tr. 3049, at p. 10). 7/

7/ Site-identification codes used by Applicant and Staff may disagree with respect to the last two digits due to consideration of different fuel and cooling alternatives.

31. Following the visit to the sites, the Staff independently analyzed site criteria based upon terrestrial ecology and land use, water availability and thermal hydrology, and potential impacts of candidate sites. As a part of these analyses, the Staff assessed the accuracy of the human population and hydrological data presented by the Applicant by independent reference to available data banks and found such data to be reasonably accurate. (Supplementary NRC Staff Testimony following Tr. 3049, at p. 9).

32. With respect to terrestrial ecology and land-use considerations, the Staff evaluated economic value of the land, condition and use of the land, people per square mile, forest acreage to be cleared for transmission and railroad right-of way, and rare or endangered species. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 9-12). On these bases, three sites were less desirable than the Perkins site: Lake Norman "E" (150512), Hartwell-LaFrance (280512), and Lower Hartwell (280612). Only one site was superior to the Perkins site, i.e., the Fishing Creek Reservoir (250612). This site is abandoned farmland with early second growth (old-field) forest on it. Much had been cleared, but the final use of the land could not be determined. The method of clearing appears to indicate site preparation for a pine plantation. The area's population density is nearly twice that of the Perkins site, but few potentially affected residences were observed. The Fishing Creek Reservoir site requires 215 miles of 525-kV transmission lines, with an estimated clearing of 4480 forest acres,

17 times the amount required for Perkins. Railroad lengths at the two sites are similar. Assuming similar acreage for the site, plus 1400 acres for the Carter Creek impoundment (a feature unique to Perkins), total land pre-emption at Fishing Creek Reservoir would be 2.2 times that at Perkins. Therefore, although the Fishing Creek Reservoir site received a higher rating than Perkins, the increased forest clearing for transmission lines tends to obviate that advantage. The Staff found that neither the Fishing Creek Reservoir site nor any other potential site was "obviously superior" to the Perkins site from the standpoint of terrestrial ecology and land use. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 12-15).

33. The Staff summarized its analyses in the following table:

Table 1. Perkins alternative site study: Staff analysis and comparisons for terrestrial ecology and land use.

Site	Site factor[a]		People per sq. mi.	Transmission lines (miles)		Forest[b] transmission line right-of-way	Railroad[b] Right-of-way	Number of Rare or Endangered Species	
	land	ecology		525 kV	230 kV			plant	animal
Fishing Creek Reservoir	1	1	144	215	0	4480	73	-	1
Lake Norman "E"	2	2	64	33	0	500	85	1	3
Wateree	2	2	24	240	0	5180	145	-	1
Clinchfield	2	2	33	109	0	2460	230	4	1
Broad	2	2	174	45	0	780	67	1	-
Middleton Shoals	2	2	71	65	85	2200	42	-	1
Hartwell-LaFrance	3	2	138	116	9	2300	121	-	1
Lower Hartwell	3	2	141	117	12	2350	121	-	1
Tuckertown	2	2	51	70	50	1570	85	6	
Perkins				8	8	260	74	1	-

[a] 1 = better than Perkins site
2 = equivalent to Perkins site
3 = inferior to Perkins site

[b] acres

34. Regarding water availability and thermal hydrology, the Staff considered environmental impacts of cooling-tower plumes, lengths of pipe and hydrostatic head, and thermal effects of the discharge of blowdown water. The Staff found each factor to be important; the differences among candidate alternate sites are insignificant. Accordingly, the Staff concluded that the major thermal and hydrological aspects in evaluating an alternate site is the availability of sufficient water for cooling towers. The Staff provided pertinent information for each subject site, and concluded that, of the alternate sites, only one -- the Broad River site -- had a marginal quantity of water available for cooling towers. The adequacy of the Clinchfield site would depend upon construction of the Clinchfield Reservoir or a similar impoundment; the remaining seven alternate sites would have sufficient water available to supply the cooling-tower requirements without causing significant environmental effects. 8/ (Supplementary NRC Staff Testimony following Tr 3049, at pp. 16-20).

35. The Staff also addressed potential aquatic impacts. The aquatic assessment was based on visits by the Staff to the alternate sites, including Perkins, as well as on reconnaissance-level information available for the alternate sites. This information is listed in the Reference section attached to the Staff's Testimony. (Following Tr. 3049). It consists of (1) basic hydrological data (e.g., streamflows) from the documents supplied by the Applicant as a result of Staff requests, as independently verified by the

8/ As will be seen subsequently, the Board has major reservations about the adequacy of the Staff's consideration of water use.

Staff; (2) impact statements completed for projects which are (or will be) located on the same or similar river systems as the sites being evaluated; (3) government reports on the limnology and fisheries of the region and on the occurrence of endangered species; and (4) miscellaneous reports on the biology of Piedmont streams and reservoirs. The Staff examined the (a) physicochemical and biotic characteristics of the rivers and reservoirs in the Carolina Piedmont (wherein Applicant's service lies), (data on fish production and composition, (c) endangered species, and (d) wild and scenic rivers, recreation, and average flows. On these bases, from an aquatic ecological standpoint, the Perkins site is believed by the Staff to be an acceptable location for the facility, since no significant effects are predicted at that site. Possibly, locating the plant at one of the alternate sites would result in even lesser effects than those predicted for Perkins. It was, however, the Staff view that such lesser effects would not be so important as to make that site clearly preferable to the Perkins site. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 21-24).

36. The Staff summarized its analysis of these parameters as follows:

Table 2. Selected hydrological and aquatic ecological data for the Perkins site and nine alternative sites.

Site	Water type	Endangered spp. likely?	Part of wild and scenic river system?	Average Flow in river or through reservoir, CFS
Perkins	River	no	no	2880
Fishing Creek Reservoir	Reservoir	no	no	4860
Lake Norman "E"	Reservoir	no	no	2600
Wateree	Reservoir	no	no	5825
Clinchfield	Reservoir	no	no	970
Broad	River	no	no	1470
Middleton Shoals	Reservoir	no	no	4214
Lake Hartwell-LaFrance	Reservoir	no	no	4400
Lake Hartwell-Lower	Reservoir	no	no	4400
Tuckertown	Reservoir	no	no	4684

Source: References 4, 12-14, 16-21; Duke Power Co. Phase I Siting Study; Duke Power Co. submittal to NRC of 8/31/78.

37. Based upon its overall analysis, the Staff compared the alternatives to the Perkins site as follows:

Sites slightly better:	Fishing Creek, Wateree, and Middleton Shoals
Sites roughly equal:	Tuckertown and Clinchfield
Sites slightly worse:	Lake Norman "E", Broad, Lake Hartwell-LaFrance, and Lake Hartwell-Lower

The Staff stated that no alternative site stands out as one which could be rated as "obviously superior". All sites examined, with the possible exception of the Broad River site, are reasonable and potentially licensable to support a 4000-MWe nuclear station with cooling towers. Differences among all the sites are subtle, and gradations among them are minor. The Staff, therefore, concluded that none of the alternative sites considered is obviously superior to the Perkins site as a reasonable and licensable site for the 3840-MWe (net) nuclear station proposed by the Applicant, Duke Power Company, based on environmental considerations. (Supplementary NRC Staff Testimony following Tr. 3049, at pp. 24-25).

38. The Board and parties inquired as to various aspects of the Staff's review. In response, the Staff stated that it had relied upon information other than that furnished by Applicant (Tr. 3056-57, 3083, 3089, 3096, 3185); that it had verified Applicant's information, and had found such to be accurate and consistent with pertinent regulatory guides (Tr. 3058, 3079-80, 3083-86, 3089, 3103, 3185, 3286-87, 3299, 3301, 3792-94); that it had conducted an independent analysis of the final alternative sites

(Tr. 3070, 3078, 3103 86-87, 3291-92, 3299, 3792); that the instant testimony complied with current Commission alternate site guidance (Tr. 3087 88, 3232); that it relied upon reconnaissance-level information (Tr. 3082, 3134); and that power-plant siting is not a precise science. Judgment must be reasonably applied, and it must be recognized that criteria vary in importance from one service area to another. (Tr. 3090-91, 3143-45). The Staff witnesses testified that they concentrated primarily upon environmental costs, not monetary costs of construction, and that they followed the guidance of NUREG-0099, Regulatory Guide 4.2, Revision 2, Preparation of Environmental Reports for Nuclear Power Stations, July 1976 (Section 9), General Site-Suitability Criteria for Nuclear Power Stations, Regulatory Guide 4.7, Revision 1, November 1975, and Commission decisions, Tr. pp. 3185 and 3186.

39. The Staff explained its efforts in reducing the sites under consideration from 38 to 10 (Tr. 3081-82, 3238-40, 3246); it stated that it considered all factors advanced by Applicant, as well as some additional factors. (Tr. 3248). It listed the factors it considered in its analysis of the final alternate sites (Tr. 3257-58, 3271-77); it explained why it did not generate its own matrix (Tr. 3164-78, 3186, 3192, 3264-67, 3291-94, 3810-14), but used that of the Applicant (p. 6 following Tr. 3049). The Staff noted that Perkins was subjected to closer scrutiny because information beyond the reconnaissance level was available from Applicant (Tr. 3082-83, 3127). The Staff maintained that the State of North Carolina's letter on which it relied to preclude present consideration of once-through

cooling was consistent with EPA's current position (Tr. 3091, 3107, 3112). 9/ The Staff agreed with Applicant that a thermal study examining the interaction of various generating units on Lake Norman is needed before more plants are built. (Tr. 3108). The Staff assumed the use of Carter Creek Reservoir by the power plant to assess the effects of the Perkins site (Tr. 3102). The Staff also corrected its FES to reflect an absence of rare or endangered species at Perkins. (Tr. 3101-02).

Board Analysis of Staff Testimony

40. The Staff has concluded that there are some sites slightly better than Perkins, some roughly equal, and some slightly worse. Although this represents the combined judgment of their experts in hydrology and terrestrial and aquatic ecology, it remains very unclear how they arrived at their conclusions. Although some factors that they considered are stated in their written testimony, it is by no means apparent how the factors were considered to be more important than others. To claim that a given site is slightly better but not obviously superior is a quantitative judgment that demands support. We find that support lacking; the basis for our finding follows:

41. One of the major disadvantages of the Perkins site is the requirement that a large reservoir be constructed to supplement

9/ The North Carolina position is consistent with the oft-discussed EPA position which has been the subject of previous Perkins hearings. (Tr. 1601-04; Applicant's testimony of L.C. Dail following Tr. 275 at p. 4). Counsel for the State of North Carolina bolstered the status of the subject letter by indicating that, as the representative of the State, he could state that it was North Carolina's present view that "Lake Norman is not suitable for once-through condenser cooling." (Tr. 2957).

the river during periods of low flow. Carter Creek impoundment is a significant expense and also has an adverse environmental impact. Most alternate sites are located on existing reservoirs. How this was taken into account by the Staff is not apparent to the Board.

42. One of the adverse environmental impacts cited by the Staff in the FES (Sec. 5.2.3) was a decrease in water quality. When the Staff was asked by Intervenors' counsel about how water quality was used in their comparison, a witness replied "In this written testimony, I don't believe that it is stated explicitly how it was used." (Tr. 3130). Although the Staff witness later claimed that water quality was considered in the comparison, he did not say to what extent or how it favored one site over another.

43. On page 7 of the Staff's testimony it is claimed that the Applicant did not give sufficient weight to seismology in comparing sites. The Staff never explained how its assignment of a higher weight entered into its comparison, or if indeed it was even considered. The Staff claimed that it weighed terrestrial ecological factors differently from the Applicant but did not explain how the different weights affected its conclusions.

44. In the FES the Staff noted that an increase in the frequency and severity of fish kills may occur if Perkins is located on the Yadkin River. Whether this was considered in comparing other sites is not apparent.

45. The Staff has noted that there will be some social-economic impact on the community near the Perkins site--that there

will be some effect on the schools and that 26 families will be displaced. Whether the alternate sites are better in this regard is not apparent from the Staff's analysis.

46. Although the list of factors that were not explicitly considered by the Staff could be expanded we are equally disturbed by their failure to show how they rated in importance the factors that they did explicitly consider. For example, there is a considerable variation in average and minimum streamflow at the various alternate sites. The average streamflow at Clinchfield site is only 1/3 of that at Perkins . Furthermore, the site depends upon the proposed construction of a reservoir by the U.S. Army Corps of Engineers. Yet the Staff rates Clinchfield as equal to Perkins. They explain this by stating that if the withdrawal of 100 cfs of water from a stream is environmentally acceptable, the other sites are essentially equal in terms of the water availability. Thus, Clinchfield is not worse than Perkins nor is Wateree (where the streamflow is double that at Perkins) any better in the Staff's rating.

47. Certainly one of the chief concerns of this Board and a major concern of the Intervenors is expressed by their contention III (A) 2 which begins "Both the Applicant and Staff have radically underestimated the effect of the proposed 880 cfs drawdown limitation upon the future water needs of the Yadkin River Basin." Both the Applicant and the State of North Carolina have made extensive studies of the adequacy of the Yadkin to meet future requirements.

If the river flow is only marginally adequate, then an alternate site on a river with much larger flow might well be "obviously superior." We are disappointed with the Staff's failure to address this important issue, either in the original proceeding [10/] or in this reopened hearing. When a Staff witness was asked by Applicant's counsel, "...and, Mr. Robertson, is it your opinion, based on independent review and reliance upon U.S. Geological Survey (USGS) figures, that there will be adequate water supplies in the river basin and the Duke Power Company service area in the future?", he replied, "I couldn't answer that question.... That would involve a knowledge of the basin that I hadn't developed." (Tr. 3096). When counsel further asked, "Are you familiar with North Carolina Environmental Management Commission discussion of future water uses in the Yadkin River Basin?", Mr. Robertson replied, "Not in any detail. I know they exist but I hadn't studied them." (Tr. 3098). In reply to a Board question, Mr. Robertson stated, "If we found that there was ample water at the site, we didn't take potential use into consideration because that would have involved predicting the future, somewhat. We had no way of knowing that industries would actually develop on these sites. So we didn't consider that." Refusal to consider future demands for water is in contrast to Staff's predictions on future needs for power.

10/ In our Partial Initial Decision we pointed out that: "The Staff did not make an independent estimate of future demands on the Yadkin River and have submitted no proposed findings regarding this contention." (LBP-78-34, 8 NRC 470, 489 (1978)).

48. In spite of the serious shortcomings in the Staff's analysis of alternate sites we nevertheless do take into account their conclusion that none of the alternate sites is obviously superior to the Yadkin River site.

Intervenors' Testimony

49. Dr. Miguel A. Medina, Jr., and Dr. Alan H. Lipkin testified for the Intervenors. Dr. Medina has a Ph.D. in environmental engineering sciences from the University of Florida. Dr. Medina has been involved in design and construction as an engineer and in research regarding water questions. He is an assistant professor of civil engineering at Duke University and has taught graduate and undergraduate courses in dynamic hydrology, water resources engineering, and environmental resources management. Dr. Medina has conducted research in storm-water modeling for the EPA and the National Science Foundation. He has been a consultant for private industry and public agencies. He has authored or coauthored seventeen technical papers and publications. His courses at Duke University at the graduate level include the study of the dynamics of circulation of currents and distribution of water, hydrometeorology, geophysical fluid motion, precipitation, surface runoff and stream flow, infiltration, water losses, hydrographic analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. His course in pollutant transport systems involves the study of the distribution of pollutants in natural water in the atmosphere, diffusive and advective transport phenomena within the

natural environment and through manmade artificial conduits, and storage treatment systems, and analytical and numerical prediction methods. He also teaches a course in environmental resources and management, which includes the standards and criteria for evaluation of environmental resources and the management of these resources. In this course the emphasis is placed on water, its distribution, estimated use, role of federal agencies, water quality legislation, parameters of pollution, and sources in control and water resources projects. (Professional qualifications of Dr. Medina following his testimony at Tr. p. 3436).

50. Dr. Medina testified that he had assisted in preparing impact statements, that he was testifying as a paid consultant, and that he favored nuclear power. (Tr. 3395 and 3396). Dr. Medina stated that he had reviewed the information supplied by the Applicant, which is set out as Exhibit 10 of this proceeding. He also stated that he had examined the Final Environmental Impact Statement for the Perkins site and the North Carolina Water Resources Framework Study issued in 1977 and other information from open literature. (See p. 1 of Medina testimony). Dr. Medina further stated that he personally inspected the Yadkin River Basin from the Yadkin College gauge down the river past the Perkins site all the way to the High Rock Reservoir and on below to the Tuckertown Reservoir. He also stated that he has personally inspected the Lake Norman sites. (Tr. p. 3444). Dr. Medina testified that the alternate site evaluation by the NRC Staff was inadequate and that the Lake Norman site and the Wateree site were clearly superior.

(See p. 1 of Medina testimony and Tr. 3445). Dr. Medina testified that the bases for his conclusion of the obvious superiority of Lake Norman were the difference in size between Lake Norman and High Rock, which are the affected reservoirs, the flow rates and the control of water flow in the respective Catawba and Yadkin basins, and the lack of the requirement for a Carter Creek Reservoir at the Lake Norman sites. (Tr. 3455, testimony of Dr. Medina at p. 2). Dr. Medina further testified that the average flow rates which were relied upon in the Yadkin Basin, where there is no reservoir control by the Applicant, is extremely unreliable in that no risk analysis was done by the Applicant on the Yadkin flow rates, which was an additional weakness in the Perkins site. (Tr. 3459). Dr. Medina testified that he had studied for his Ph.D. under one of the professors who designed the Ryan and Harleman model which had been used by the Applicant to measure the environmental impact of lake cooling on Lake Norman. He stated that a computer model of a proposed Perkins Plant on Lake Norman could be run in two to three weeks and should be done to determine the likelihood of using surface cooling as an alternative to cooling towers on one of the Lake Norman sites. (Tr. 3701, 3702, 3703, and 3704). Dr. Medina further testified that the Lake Norman site was preferable because of the greater volume of Lake Norman which provided four times the dilution factor as that of High Rock Lake. (Tr. 3696).

51 Dr. Alan H. Lipkin is an Assistant Professor of Chemistry at Winston-Salem State University. He received a Ph.D. in organic chemistry and has been teaching general chemistry, organic chemistry,

investigations and research in chemistry, and seminars in chemistry since 1973. He has been a consultant for private and public agencies, and specifically has been involved in organic synthetic procedures, glassware, glass blowing and glass sculpture, and has set up analytic procedures for certain metals. He has written four publications in addition to his thesis and is an active chess champion. (Professional qualifications of Dr. Lipkin attached to the testimony of Dr. Lipkin, following Tr. 3438). Dr. Lipkin testified that the Staff evaluation was deficient in many particulars. He had prepared a detailed matrix which was based upon an article written by a Mr. Joplin of Florida Power and Light Company, which was obtained from the files of Duke Power Company. Dr. Lipkin factored the Applicant's raw material into the Joplin matrix and in certain portions of the matrix factored in his own evaluations. He concluded that there were several sites obviously superior to the Perkins site. (See testimony of Dr. Lipkin and his attached exhibits following Tr. 3436, and the testimony of Dr. Medina).

52. Dr. Lipkin testified that he considered the Perkins site to be an adequate site, but that the other sites which he evaluated in his matrix were better sites. (Tr. 3513). Dr. Lipkin explained that he used the Joplin method and Duke Power Company information as much as possible and that he supplemented this with his own knowledge of the material provided by the Applicant in Staff Exhibit 10. (Tr. 3554, 3556, 3605, and 3614). Dr. Lipkin identified some of the obvious comparative factors between Lake Norman and the Perkins site as the considerable difference in size of the two reservoirs and

the possible versatility of once-through cooling at the Norman site. (Tr. 3527 and 3530). He also referred to the requirement of a Carter Creek impoundment at the Perkins site which was not required at the Lake Norman sites. Dr. Lipkin further pointed out that the Joplin matrix which he used was conservative on the crucial water question in that the Joplin matrix only provided for a 32% consideration of water matters and the Duke matrix provided for approximately twice that much consideration to water (Tr. 3645). The Lipkin matrix rates the Perkins site at 168 and the Lake Norman "E" at 202, which represents, according to Dr. Lipkin and his use of the Joplin matrix and the Applicant's information, an obviously superior rating for the Lake Norman site. (Tr. 3645-48).

Board Analysis of Intervenors' Testimony

53. Dr. Medina argued that the choice of a site on the Catawba River, such as Wateree or Lake Norman "E", would be far superior to the proposed site on the Yadkin. He particularly advocated locating Perkins on Lake Norman with once-through cooling. This would greatly reduce the consumptive use of water (compared with cooling towers), would eliminate the expense of cooling towers, and would reduce the terrestrial impact since no additional reservoir (such as Carter Creek) would be needed. Whether Lake Norman is adequate for an additional large generating plant in addition to those proposed is arguable. However, it is apparent that the State of North Carolina will not license once-through cooling. (State of North Carolina, Tr. 2957; Staff testimony, p.8 following Tr. 3049. See also footnote No. 9 following paragraph 39

of the instant decision).

54. Dr. Medina concluded that Lake Norman "E" would be a better location for Perkins even if it were designed to use cooling towers. An impoundment such as Carter Creek would not be needed, a distinct advantage. However, it is by no means clear that the Catawba River would be less affected by the consumptive use of water. It has higher water quality than the Yadkin but there is no evidence that this is an important consideration. Dr. Medina testified that there are more water storage areas and dams on the Catawba River above the Lake Norman site than there are above the proposed Yadkin River site--consequently, there is the possibility of more uniform flow. Conversely, however, the average flow of the Catawba is less than the Yadkin and it now has greater variation in flow rate.

55. Dr. Medina also argues that the volume of Lake Norman is four times greater than High Rock and it therefore would provide greater dilution. It is by no means clear that this is an important consideration, since Perkins is located many miles above High Rock Lake and we have previously found that the impact of Perkins on High Rock Lake will not be serious

56. We agree with Dr. Medina that Lake Norman "E" would be a good site for the Perkins plant but the evidence to show that it is 'obviously superior' to the Yadkin River site is lacking.

57. Although the Board found Dr. Lipkin's attempt to apply the Joplin matrix to the Perkins site and his choice of alternate to be very interesting, he lacked sufficient reliable data to

include in his matrix to arrive at a convincing demonstration of site superiority. Most of his data came from the Applicant in Staff's Exhibit 10. His attempt to fit data from the Applicant's matrix to the Joplin matrix was not convincing.

58. With regard to Dr. Lipkin's criticism of the Staff evaluation, we agree that he has pointed out a number of inadequacies. Our views in this matter are summed up in our evaluation of Staff testimony.

Analysis of Applicant's Testimony

59. As we pointed out above, the Applicant's Phase-I Siting Study was carried out, using reconnaissance data, to select a number of sites which might be suitable for locating future fossil and nuclear power plants. Of the 38 best sites, 8 were considered suitable for the location of a 4000-MWe nuclear station. An assignment of rating factors and weight to each of the environmental factors evaluated by the Applicant led to an assignment of quality points to each of the sites. The quality points ranged from 144 for Lake Hartwell to 122 for Broad (Table 6--Phase-I Siting Study). We agree that the method used by Applicant has led to a selection of the sites alternative to Perkins.

60. At the request of the Staff, the Applicant made an evaluation of the Perkins site using the same environmental factors and rating points. This analysis showed that Perkins had a rating of 144 points, the same as Lake Hartwell, and led the Applicant to conclude that there was no site obviously superior to Perkins.

(Attachment 2 to Applicant's August 7, 1978 response to Staff. Staff Exhibit 10).

61. The relatively high rating of the Perkins site was a consequence of the assignment of the maximum number of quality points (15) to Perkins with respect to such important factors as 1) water availability during low flow--15 points; 2) reductions in stream flow--15 points; and 3) water shortage area--15 points. Both the Board and the Intervenor questioned this assignment--the Staff apparently accepted the ratings without serious question. We particularly focused our question on the comparison with Lake Norman.

62. A rating of 15 points was given to both Lake Norman and Perkins with regard to reduction in stream flow because the consumptive use of water by Perkins is less than 5% of the stream flow. Perkins' projected consumptive use is 2.4% of the average stream flow of the Yadkin; it would be 2.9% of the Catawba if located on Lake Norman. (Tr. 3736). The comparison of the two sites is unbiased; certainly Lake Norman is not superior in this respect.

63. Undoubtedly, water availability during low-flow conditions is a very important consideration. However, the situation at Perkins site is very much relieved by Carter Creek impoundment. There will be no net withdrawal when the flow is less than 1000 cfs, so the maximum effect would be a 10% reduction in flow from 1100 cfs to 1000 cfs. Although this will have some adverse effect on water quality and dilution capacity, we have considered it to be acceptable

in view of the benefits. Whether the situation would be improved at a Lake Norman site is not evident. Water quality in the Catawba River is considerably better than the Yadkin River, which may be a plus but is arguable. There are more dams and reservoirs above Lake Norman than there are above Perkins, so it would be easier to regulate the flow. But at present the 7_Q10 flow in the Catawba is much less than the Yadkin. The benefits of a smoothed flow would depend on the adoption of government regulation. It is not apparent that Lake Norman is indeed better with respect to water availability during low flow. The Applicant's assignment of 15 points to each site is reasonable. Lake Norman is not obviously superior in this respect.

64. The Intervenor has contested the Applicant's assignment of 15 quality points to the Perkins site with respect to "water shortage area." The Applicant has assigned 15 points to both Perkins and Lake Norman. The record does not show the criteria used by Duke Power Company in assigning points for the siting factor "water shortage area." The Staff has taken no position. As discussed in our Partial Initial Decision, the State of North Carolina held extensive hearings before deciding that the Yadkin was not a capacity-use area.

65. In our Partial Initial Decision, we recognized that perhaps the most serious impact of Perkins was the consumptive withdrawal of 100 cfs of water from the Yadkin River. At that time we relied heavily on the findings of the North Carolina State Environmental Management Commission in arriving at our conclusion

that the impact would be tolerable in light of the benefits even when projected into the future. We also adopted the North Carolina State condition of zero net withdrawal when the river flow falls below 1000 cfs. We now must decide whether any of the alternate sites are obviously superior, particularly when the water requirements of future users are considered. We have particularly focused on sites such as Norman "E" and Wateree on the Catawba River in view of the testimony of Intervenors' witness Medina.

66. Although Dr. Medina pointed out that the water quality in the Catawba was better than the Yadkin and that there was more capability for smoothing out stream flow on the Catawba, he did not demonstrate that the Catawba Basin was better able to accommodate the loss of water from a large nuclear station than the Yadkin.

67. Applicants' witnesses Dail and Blackman compared the Catawba and Yadkin rivers with respect to their relative capacities to tolerate electric generating stations. Both rivers have such stations at present. If Perkins is completed and operated, there will be on the Yadkin 4.9 MWe of power generated per cfs of flow at 7_Q10 conditions. The corresponding figure on the Catawba is 12.11 MWe. The Catawba will bear nearly double the stress of the Yadkin. (Tr. 3677). They also compared the two river basins with regard to projected consumptive loss due to electric generating stations per million inhabitants in the respective river basins. For the Catawba Basin the figure is 76.7 cfs per million people; for the Yadkin Basin (with Perkins) it is 68.5 cfs. Demand upon the

two river basins will be approximately equal if Perkins is located on the Yadkin. (Tr. 3742). If one compares the projected generating capacity in each basin with the respective drainage areas, the Catawba will have 1.8 MW/mi^2, the Yadkin (including Perkins) only 0.7 MW/mi^2. It would thus appear that the Yadkin River is a preferable location for a large power station.

68. The State of North Carolina concluded that the areas available for future expansion of wet industries was equally large (or larger) for the Yadkin Basin compared to the Catawba.

69. On the basis of the record, it is not apparent that any of the proposed sites on the Catawba River Basin is obviously superior to the Yadkin River Site with respect to consumptive use of water by the nuclear station. If all environmental impacts are considered, Perkins is one of the best--no other site is obviously superior.

Factual Conclusion

70. We have carefully considered the testimony of the Applicant, Staff, and Intervenors. On the basis of the record and for the reasons stated above, we find that there is no site obviously superior to the one proposed for Perkins on the Yadkin River.

No Conclusion of Law

71. The Board determined that it was appropriate to issue this Partial Initial Decision since it appears that consideration of alternate sites will not be affected by the consideration of the two motions from the Intervenors now filed with the Board --

April 3, 1979, to reopen the record due to Three Mile Island 2; and on July 10, 1979, to dismiss the proceedings or stay the proceedings indefinitely, due to the schedule adjustment of the Applicant's need for the Perkins units. The Board cannot rule on either motion at this time because additional filings are to be received from the parties.

72. Since the matter of the alternate site consideration is within the cost/benefit conclusion of law required by NEPA, there can be no conclusion while other environmental matters are still subject to possible further consideration.

THE ATOMIC SAFETY AND
LICENSING BOARD

Walter H. Jordan, Member

Donald P. de Sylva, Member

Elizabeth S. Bowers, Chairman

Dated at Bethesda, Maryland
this 22nd day of February 1980.