UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

SERVED OCT 30 1978

In the Matter of	)	
	)	
DUKE POWER COMPANY	)	Docket Nos. STN 50-488
	)	50-489
(Perkins Nuclear Station,	)	50-490
Units 1, 2, and 3)	)	October 27, 1978

PARTIAL INITIAL DECISION
(Construction Permit Proceeding)

Appearances

J. Michael McGarry, Esq., Debevoise & Liberman, 806 15th Street, N.W., Washington, D.C. 20005 and William L. Porter, Esq., Legal Department, P.O. Box 2178, Charlotte, N.C. 28242
For the Applicant, Duke Power Company

William G. Pfefferkorn, Esq., 2124 Wachovia Building, Winston-Salem, N.C. 27101 and Thomas S. Erwin, P.O. Box 928, Raleigh, N.C. 27602
For the Intervenors

Bernard M. Bordenick, Esq., Charles A. Barth, Esq., and Joseph F. Scinto, Esq., Office of the Executive Legal Director, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555
For the NRC Regulatory Staff

TABLE OF CONTENTS

PARTIAL INITIAL DECISION
(Construction Permit Proceeding)

I. BACKGROUND

1. This Decision considers Duke Power Company's ("Duke" or "Applicant") application to construct and operate the Perkins Nuclear Station, Units 1, 2, and 3[1/] which was filed with the Atomic Energy Commission[2/] on March 29, 1974. Perkins is proposed to be located on the Yadkin River in southeastern Davie County, North Carolina. Its design calls for 3 pressurized water reactors each of which is designed for operation at a power level of 3817 megawatts thermal and a net output of 1280 megawatts electric.

1/ Perkins is the sister plant of Duke's Cherokee Nuclear Station, Units 1, 2, and 3 planned for eastern Cherokee County, South Carolina, on the Broad River. Together they comprise Duke's Project 81 which employs the concept of engineering standardization which is based on utilizing the same design for multiple sites. (Tr. 205-206; see also the Commission's Statement of Considerations at 40 Fed. Reg. 2974). The nuclear steam supply system standard design in this instance is Combustion Engineering, Incorporated's ("CE") System 80 design for which the NRC Staff has issued a generic safety evaluation ("SER") pursuant to 10 CFR Part 50, Appendix 0. (Staff Exhibit 8, SER, Appendix A admitted at Tr. 2010).

2/ Pursuant to the Energy Reorganization Act of 1974, 42 U.S.C. §5801, et seq., the Nuclear Regulatory Commission ("NRC") succeeded to the licensing and regulatory functions of the Atomic Energy Commission. The NRC and AEC will be referred to here as the "Commission."

2. On July 19, 1974, the Commission published in the Federal Register a notice entitled "Hearing on Application for Construction Permits." (39 Fed. Reg. 26470). This notice ordered a hearing to be held to consider issues pursuant to the Atomic Energy Act of 1954, as amended, 42 U.S.C. §2011, et seq., and the National Environmental Policy Act of 1969 ("NEPA"), 42 U.S.C. §4321, et seq. It also provided that any person wishing to participate in the proceeding as a party should file a petition to intervene by August 19, 1974.

3. On August 16, 1974, the State of North Carolina petitioned to participate as an interested state pursuant to 10 CFR §2.715(c). There was no objection to this petition and it was granted by the Board on July 2, 1975.

4. In early June 1975, Mary Apperson Davis and the Yadkin River Committee filed a late petition to intervene; the petition was granted on November 21, 1975.

5. On July 26, 1976, Mr. David Springer filed a "Motion To Dismiss" and a "Petition To Intervene" questioning the jurisdiction of the NRC to issue a construction permit. By Orders dated July 15 and September 6, 1977, the Board denied the motion and petitions to intervene filed by

Mr. Springer. The Board found that none of the documents filed by Mr. Springer, either alone or in combination, constituted a timely petition to intervene and that he had failed to show good cause for failure to file on time. These denials were affirmed by the Atomic Safety and Licensing Appeal Board in its Orders of September 8 and 16, 1977. (See ALAB-431 and ALAB-433, respectively 6 NRC 460 and 469).

6. Public hearings were conducted in this matter on April 26-30, May 6, 1976, and April 28-29, July 18-21, 1977,[3/] to consider environmental and health and safety issues. The parties presenting evidence at the hearings were Applicant, Staff, Intervenor, and the State of North Carolina.

3/ The health and safety aspects of the Cherokee and Perkins applications were combined into one 4-day hearing session with evidence being taken at Gaffney, South Carolina, on the first two days and at Mocksville, North Carolina, on the third and fourth days. Thus, the Cherokee transcript for July 18 and 19, 1977, contains the first portion of the hearing and the Perkins transcript for July 20 and 21, 1977, contains the final two days. The Perkins Intervenors did not participate in that part of the hearing held at Gaffney but were provided transcripts of the proceedings and were given the opportunity to cross-examine the witnesses that appeared at Gaffney during the sessions at Mocksville. The pertinent parts of the Cherokee transcripts were received into the Perkins record (Tr. 2245).

7. On June 15, 1978, the Staff filed a motion to reopen the evidentiary record in this matter because, it concludes, "the Staff's review of alternative sites for the Perkins facility falls short of the guidance set forth by the Appeal Board in Pilgrim" and Seabrook.[4/] The Staff indicates that it is developing a schedule for its reanalysis of alternative sites. The Intervenors have indicated in motions of their own that they feel the alternate site analysis is insufficient though their emphasis is not so general as is the Staff's. Intervenors' primary concern is that the Lake Norman site proposed by them (and in an intervention attempt by a Mr. Springer) has not been considered. The Applicant opposes the position of the Staff and the Intervenors in this regard and states its reasons in a carefully and ably prepared document dated June 27, 1978.

4/ Boston Edison Company (Pilgrim Nuclear Generating Station, Unit 2), ALAB-479, May 25, 1978, slip opinion and Public Service Company of New Hampshire, et al. (Seabrook Station, Units 1 and 2), ALAB-471, April 28, 1978, slip opinion.

8. The Board determined in its Order of July 14, 1978, that while the Staff may be in most respects like other parties, it has obligations under NEPA that other parties do not share. One of the Board's duties is to review the record and to determine whether the Staff has performed its NEPA function. If that finding cannot be made then no license may be authorized. Thus, if the Staff has not performed adequately its NEPA function, that inadequacy is not cured because the Staff is late in drawing attention to it or has failed to show that a new review would change things. We are convinced that the evidence now in the record would not permit approval of the Staff's alternate site review. The Staff's motion was sustained and the record is reopened for new evidence regarding the Staff's analysis of sites alternate to the Perkins site.

9. On April 11, 1978, the Commission amended Table S-3 relative to radon releases from the uranium fuel cycle and directed Licensing Boards in pending proceedings to reopen the record. Following an evidentiary hearing, this Board issued a Partial Initial Decision on July 14, 1978.

10. The decision record in this proceeding consists of the transcripts ("Tr.") covering the prehearing conferences of June 13, 1975, and April 5,1976, the evidentiary hearings referenced above and all exhibits received into evidence by the Board.

II. FINDINGS OF FACT ON ENVIRONMENTAL IMPACTS

A. BASIC FINDINGS

General

11. On March 29, 1974, Applicant submitted an Environmental Report ("ER") pursuant to 10 CFR Part 51, to which it subsequently added Amendments 1 through 4. This ER, as amended, was admitted into evidence as Applicant's Exhibit 1. (Tr. 266). It contains detailed information on and evaluations of the environmental impacts associated with the construction and operation of the facilities.

12. Based on the information submitted by the Applicant in the ER, and on its own review and analysis, the Staff prepared a Draft Environmental Statement ("DES") which was issued in May of 1975. Copies of the DES, with requests for comments, were sent to appropriate federal, state, and local agencies.

A Notice of Availability of the DES, with request for comments, was published in the Federal Register on May ., 1975. (40 Fed. Reg. 20370). Applicant, one individual and thirteen federal and state agencies commented on the DES. (FES, Appendix A). The Staff then prepared a Final Environmental Statement ("FES") which was issued in October 1975. (Staff Exhibit 2, Tr. 402). A Notice of Availability of the FES was published in the Federal Register on October 20, 1975. (40 Fed. Reg. 47878). The FES concludes that the action called for under NEPA and 10 CFR Part 51 is the issuance of construction permits for the plant subject to certain conditions for protection of the environment. (FES, p. ii-iii).

Impacts of Construction

13. Construction related activities will disturb approximately 400 acres at the Perkins site and about 1400 acres at the Carter Creek Impoundment, a supplemental water storage pond. Virtually all of this land is either forest, farmland, or pasture. (ER, §§4.1, 4.1.6, Table 5.1.4-1; FES, §4.1, Table 9.4). The activities will result in increased turbidity in the Yadkin River during consideration but it will be reduced by Applicant's erosion control plan. (ER, §§4.1.1.5, 4.1.1.6, 4.1.4; FES, §4.2.1).

14. About 400 acres of land will be cleared for the transmission lines that connect the plant to the Duke system. The routes have been selected to minimize environmental impact. Lines will be constructed and maintained according to the appropriate federal guidelines for transmission right-of-way construction and maintenance. (ER, §4.2; FES, §4.1.3). About 77 acres of land will be required for the construction of a railroad spur. (ER, §4.1.1.4; FES, §4.1.4).

15. Clearing for construction and site development constitutes an impact on local flora and fauna. Impacts on the fauna include killing and displacement of numerous animals which will result in a reduction of the population of the species involved. (FES, §4.3.1).

16. The construction of Perkins will displace some twenty-six families at the plant site and sixteen families at the Carter Creek Impoundment. Traffic on local roads will increase. The housing and schools are adequate to accommodate the influx of construction workers, which at peak will be about 2600. (ER, §4.1, Table 5.1.4-1; FES, §§4.4.1, 4.4.3; Tr. 1235-1236).

17. The Board finds that the environmental impacts of construction will be acceptable particularly in light of Conditions 7(a)-(e) in the FES, to which Applicant has agreed. (Tr. 288).

Impacts of Operation

1. Radioactive Effluents

18. Potential environmental impacts of operating the Perkins Nuclear Station include the effects of radioactive effluents, the effects of non-radioactive effluents such as salts, chemicals, and heated water, as well as the possible effects of entrainment and impingement upon the aquatic organisms. The effect of the consumptive use of water upon the Yadkin River and High Rock Lake has been a major concern of the Intervenors and will be considered below.

19. The effects of low-level radiation discharged during routine operation have been evaluated. The sources of radioisotopes in liquid wastes are the small amounts of fission products that leak from the fuel rods into the reactor cooling water and activated corrosion products in the cooling water. Leaks in equipment and piping systems that contain reactor

cooling water, and liquids from decontamination processes make up the liquid waste. These liquid wastes are classified, collected, and treated by filtration, demineralization, evaporation, or a combination of these methods, and are either recycled for inplant use or released after dilution. (ER, §§5.2, 5.3.2; FES, §3.5.1). In estimating radiation doses from liquid effluents, consideration was given to pathways including drinking water, eating fish, swimming, and consuming meat and milk from animals which use the river for drinking water.

20. Most of the fission product gases that leak from the fuel elements will be collected in tanks and held up until the short-lived radioactive species have decayed. There will, however, be some leakage at valve stems and seals and consequently there will be some escape of radioactive noble gases (such as xenon and krypton), tritium, carbon-14, radioactive iodine and particulates. (FES, §§3.5.2, 5.4.2).

21. The Staff presented testimony on the "as low as reasonably achievable" radioactive releases as set forth in 10 CFR Part 50, Appendix I. (Parsont following Tr. 616).

This testimony updated the presentation contained in FES, §5.4.2 and included the results of a detailed Staff assessment of the matter. Specifically, the Staff evaluated the radioactive waste management systems proposed for Perkins (Id., at 2) and based on more recent data supplied by Applicant and on changes to the Staff's calculational model, generated new liquid and gaseous source terms to determine conformance with Appendix I. (Id., at 3). Included in the Staff's analysis were dose evaluations of three effluent categories: (1) pathways associated with liquid effluent releases to the Yadkin River; (2) noble gases released to the atmosphere; and (3) pathways associated with radioiodines, particulates, carbon-14, and tritium released to the atmosphere.(Id., at 3). The Staff concluded that the doses associated with the normal operation of Perkins meet the design objectives of Sections II.A, B, and C of Appendix I and that the expected quantity of radioactive materials released in liquid and gaseous effluents and the aggregate doses meet the design objectives set forth in RM-50-2. (Id., at 6). Further, the Staff's evaluation shows that Applicant's proposed Perkins design satisfies the criteria specified in the option provided by the Commission's

September 4, 1975, amendment to Appendix I and, therefore, meets the requirements of Section II.D of Appendix I. (Id., at 6). In sum, Staff found that Perkins' proposed liquid and gaseous radwaste management systems meet the criteria set forth in Appendix I and are, therefore, acceptable. (Id., at 7).

22. The Board notes that in choosing the Appendix I option provided by the Commission on September 4, 1975, the Applicant is committed to lower doses to offsite individuals than would be required under the unamended regulation. We also note the Applicant's commitment to non-removal of radwaste equipment as stated in Appendix B of the FES.

23. The Staff has also estimated the integrated exposure to the U.S. population resulting from the liquid and gaseous effluents from Perkins. The estimated whole-body exposure of 77 man-rem per year is negligible compared to that from natural background.

24. The major component of population exposure due to operation of the plant will be that due to the occupational exposure of plant personnel. Although no individual will receive more than 5 rem/yr., the total dose to all employees may be as high as 1400 man-rem/yr.

25. The Board finds that no significant environmental impacts are anticipated from radiation exposure resulting from normal operations.

2. Non-Radioactive Effluents

26. Perkins will withdraw up to 135 cfs of the Yadkin River including a maximum of 104 cfs for evaporative losses in the cooling towers, 31 cfs maximum for cooling tower blowdown and 0.25 cfs for cooling tower drift. The 31 cfs of cooling tower blowdown will be returned to the river after use. Perkins will also use and return to the river 150 cfs on an intermittent basis for dilution of radioactive waste. (Applicant's testimony of L.C. Dail at p. 5, following Tr. 275).

27. The average flow of the Yadkin River is 2880 cfs. (Dail, p. 3, following Tr. 275). However, during periods of drought the daily average flow has been as low as 330 cfs; the 7Q10 flow is 625 cfs. The Applicant plans to create an artificial lake by impounding Carter Creek. Water from Carter Creek Impoundment can be used to supplement the flow of the river during periods of drought. This matter was considered at length by the State of North Carolina during the proceedings which considered a discharge permit for the

Perkins Nuclear Station. The State has granted a discharge permit (State Exhibit 1) subject to the following conditions:

(a) Duke will make no net withdrawals from the Yadkin River when the stream flow is less than 1000 cfs (645 MGD)

(b) Duke will limit net withdrawals to not more than 25% of the total stream flow, or not more than that portion of this measured stream flow that is in excess of 1000 cfs, whichever is the lesser quantity

(c) Duke's maximum daily consumptive use of water due to forced evaporation will not exceed 112 cfs (72 MGD).

28. The Board adopts the above condition as minimum conditions for licensing the nuclear plant.

29. The consumptive use of 104 cfs maximum (average 68.8 cfs - see Dail, p. 8) and the return of heated and chemically altered blowdown will have an adverse impact on the river. These impacts have been considered by the Staff (FES, §5.2) under the assumption that Perkins make no net withdrawals when the river flow falls below 880 cfs.

30. The cooling tower blowdown will contain about 10 times the concentration of salts that are present in the ambient river water. This will result in a minor increase in the salt concentration in the river and will not adversely affect the quality of the water for municipal or industrial use downstream. (FES, §5.2.1.1).

31. One of the most important uses of the Yadkin River is to carry wastes from municipal waste treatment plants and from industry. It is apparent that the river is already overburdened during periods of minimum flow. Fish kills have resulted and have been attributed to the high biochemical oxygen demand (BOD) resulting from excess wastes in the river. These adverse effects become more serious during periods of low flow. Since Perkins will not, on balance, withdraw water during periods of low flow, it will not contribute to the reduced assimilative capacity of the river during such periods. There will continue to be critically low flow conditions in the Yadkin River whether or not Perkins operates. Perkins will reduce the average flow of the river whenever the flow exceeds 1000 cfs and hence reduce the assimilative capacity of the river by an amount proportioned to its consumptive use. These matters will be considered more thoroughly in connection with Intervenors' Contention III(A)4.

32. The blowdown from the cooling towers will continually discharge a maximum of 35 cfs of heated water into the river. Under average river flow conditions the Applicant has estimated the area of the heated plume ($3^{o}C$ isotherm) would be 142 acres (Dail, p. 15,following Tr. 275) and extend no more than one-third of the width of the river. The Staff has estimated that even under low flow conditions (7Q10) the $5^{o}F$ isotherm would extend no more than half the width of the river. (FES, §5.3.1.2).

33. The Staff has made an independent evaluation of the effects of the thermal plume on the aquatic environment. They conclude that under summer conditions, the area of the plume will be small and there should be no appreciable adverse impacts. (FES, p. 5-31). During winter conditions there is a potential for a cold kill of fish if the temperature of the plume were to drop suddenly. However, the volume of heated water is small so very few fish could be kept in a warm region for an extended period. They consider that the potential for cold-shock fish fills will be negligible. (FES, p. 5-32).

34. Since an appreciable fraction of the Yadkin River is used for cooling the Perkins Nuclear Station, the effects of entrainment of river biota and the possible impingement

of fish on the intake screen must be considered. The Staff concludes that fish impingement losses at Perkins Nuclear Station should be insignificant due to good design of the intake structure. They also conclude that entrainment losses of phytoplankton and zooplankton will not have a serious impact on the biota of the Yadkin River. (FES, p. 5-32).

35. The Applicant plans to add chlorine to the water circulating through the condenser and cooling towers. Daily application of chlorine will be made to control the growth of organisms and thus prevent fouling of the heat transfer surfaces. This could result in a free residual chlorine concentration of 1 ppm in the blowdown which might result in fish kills. (FES, §5.5.2.2). However, during the course of this proceeding the Applicant has proposed that blowdown be held up for a considerable period following chlorination. The concentration of total residual chlorine will drop continuously during this period. Blowdown will be held up until the level has dropped to 0.2 ppm. The Staff has re-evaluated the effect based on this commitment and finds it acceptable for protection of the aquatic environment. (Staff response to Board Question 5 following Tr. 1227). The Board includes this commitment as a license condition.

36. In addition to the impacts noted above, consumptive use of water from the Yadkin River will contribute to the eutrophication of High Rock Lake, have a minor effect on the Lake levels, and reduce the amount of hydropower from dams below Perkins Nuclear Station. These impacts will be considered under contested issues.

37. The vapor plume from the cooling towers will result in some increase in fogging and icing but the increases should be insignificant. (ER, §5.1.5; FES, §5.1.1). Droplets from the cooling towers will carry some 250,000 lbs/yr of solids which will be deposited on the land surrounding the station. The Staff estimated that the maximum fallout would amount to about 13 lb/acre/yr. (FES, §5.3.2.3).

38. The area in the immediate vicinity of the Perkins Nuclear Station site is rural and sparsely populated. Terrestrial impacts are expected to be minimal. The increased burden on local schools and other demands for governmental services should be insignificant. (FES, §5.6).

3. Effects of Accidents

39. The environmental effects of accidents have been assessed by the Applicant.(ER, P7). The Staff has reviewed the Applicant's assessment, has made independent calculations, and has concluded that under realistic assumptions the radiation dose to a nearby resident from a so-called "design basis accident" would be less than that allowed by 10 CFR 20. They did not consider accidents which involve failure of the containment vessel because a Staff Study (WASH-1400) has concluded that such accidents are exceedingly improbable. On the basis of the record of this proceeding the Board concludes that the environmental risks due to postulated radiological accidents are extremely small.

4. Transportation of Fuel and Radioactive Waste

40. Transportation of fuel to and from the site and of radioactive waste from the site will be in accordance with Commission Regulations, requirements of the Department of Transportation, and applicable state regulations. (ER, §5.3.4.2; FES, §5.4.2.4). Under normal shipping conditions, there will be small unavoidable radiation exposure to the transportation personnel and to the general public along

the route. (FES, §5.4.2.4). Under postulated accident conditions, the probability of significant exposure is also small. Since the facilities at Perkins, their operation, and associated activities are as described at 10 CFR 51.20(g)(2), the environmental impact of the transportation of fuel and radioactive waste to and from the plant is as described in Summary Table S-4 of Section 51.20 and is negligible.

5. Environmental Consequences of the Uranium Fuel Cycle

41. The environmental consequences of the uranium fuel cycle associated with the operation of the Perkins Nuclear Station were considered in the FES (dated October 1975) by including Table S-3[5/] and by factoring those consequences into a cost-benefit balance. On March 7, 1977, the Commission promulgated its final interim rule as to environmental impact values for the uranium fuel cycle which amended Table S-3. At the hearing, the Staff provided testimony that the new figures contained in the revised Table S-3 were so little different from those in the original Table S-3 that the cost-benefit balance would not be disturbed. (See Affidavit of Robert A. Gilbert at 6, following Tr. 1778; see also 1779-1782).

5/ Table S-3 is part of 10 CFR Part 51.

42. In addition to presenting the revised Table S-3, the Staff presented an analysis comparing the health effects associated with the coal and nuclear fuel cycles. In making this evaluation, Dr. R.L. Gotchy considered the entire fuel cycle associated with each alternative. The coal fuel cycle consists of mining, processing, transportation, power generation, and waste disposal. The nuclear fuel cycle includes mining, milling, uranium enrichment, fuel preparation, fuel transportation, power generatic , irradiated fuel transport, reprocessing (if permitted) and waste disposal. (See Supplemental Testimony, R.L. Gotchy, following Tr. 1740). The Applicant also presented testimony concerning the health effects associated with the coal fuel cycle. (See Testimony of Lionel Lewis, following Tr. 1776).

43. After the close of the evidentiary record in this proceeding, one of the members of this Board prepared a memorandum which was transmitted to the Commission. The chief thrust of this memorandum was to bring into question the Table S-3 value for the amount of radon (Rn-222) emitted from tailings piles associated with uranium mills.

44. On April 11, 1978, the Commission amended Table S-3 by removing the value contained in the Table for radon

releases from the uranium fuel cycle.[6/] The Commission directed that in proceedings pending before Licensing Boards, the record be reopened for the limited purpose of receiving new evidence on radon releases and on health effects resulting from radon releases.

45. In response to the Commission's directive, a public hearing was convened on May 16 and 17, 1978, in Bethesda, Maryland, to receive evidence on the amount of radon that might be released into the environment resulting from the mining and milling of an amount of uranium sufficient to supply the Perkins Nuclear Station for 40 years of operation. The subsequent health effects were also considered.

46. In reviewing the testimony presented at that hearing (Tr. 2247-2666) and the subsequent deposition of Dr. Kepford (Tr. 2667-2819) we cannot agree with the Staff that we should consider only potential deaths attributable to the nuclear cycle over the next 1000 years. Neither can we agree with the Intervenors that we must consider possible deaths that may occur millions - even billions - of year in the future due to the radon from unstabilized tailings piles and un-

---

6/ 43 F.R. 15613.

filled mining pits. We conclude that "when it comes to balancing adverse impacts to those descendants who may follow a million years from now against the benefits to the present generation, we would weigh (heavily) benefits to the present population." (See Perkins, Partial Initial Decision - Environmental Consequences of the Uranium Fuel Cycle, ₱49). In comparing the impact of coal and nuclear cycles on future generations "we believe that future generations will be better off if Perkins is nuclear." (Ibid., ₱50). We have further found" . . . that the best mechanism available to characterize the significance of radon releases associated with the mining and milling of the nuclear fuel for the Perkins facility is to compare such releases with those associated with natural background. The increase in background associated with Perkins is so small compared with background and so small in comparison with the fluctuations in background, as to be completely undetectable. Under such a circumstance the impact cannot be significant." (Ibid., ₱51). In conclusion we have stated" . . . this Board has carefully considered available information concerning the releases of radon-222 associated with the uranium fuel cycle and health effects that can reasonably be deemed associated therewith, and

concludes that such releases and impacts are insignificant in striking the cost-benefit balance for the Perkins Nuclear Power Station." (Ibid., ₱52).

6. Alternative Sources of Power

47. Possible alterr ative means considered for furnishing the projected energy capability of the facility included the possible purchase of power, upgrading of older plants, base-load operation of an existing peaking facility, hydroelectric power, fossil fuel plants, geothermal, solar, and other unproven types of generation. (ER, ₱9.2; FES, ₱9.1.1, ₱9.1.2). The Staff concluded that the only viable alternative to nuclear power was coal; that nuclear was cheaper than coal with no offsetting environmental advantages of coal over nuclear. The Staff's evaluation was made prior to the discovery of the error in Table S-3 for radon. On the basis of the complete record of this proceeding we conclude that the adverse environmental impacts of nuclear are less than those of coal. There are no other viable alternatives for producing the power generated by Perkins.

48. The Staff and the Applicant have considered alternative cooling systems. (FES, §9.2.1). At the Perkins site only cooling towers or cooling ponds were considered since the river flow is not adequate for once-through cooling. 7/ The Applicant has chosen circular mechanical-draft towers for Perkins chiefly on the basis of cost. The Staff believes that a cooling pond, in view of its large size, would be impractical at the Perkins site. Three natural draft towers would be a viable alternative but do not offer significantly smaller environmental impacts. The mechanical draft towers are an acceptable method of cooling the Perkins Nuclear Station.

7. Alternative Sites

49. The matter of alternative sites has been considered at length during this proceeding. On June 15, 1978, the Staff filed a motion to reopen the record to take further evidence

---

7/ In reply to a Board question Applicant's witness Dail stated that since the average flow of the Yadkin River was only 2880 cfs it could not supply the amount of water required for once-through cooling, namely some 5500 to 6000 cfs (Tr. 1024, 25).

on Staff review of alternate sites. The motion was opposed by the Applicant. We have agreed with the Staff and on July 17 this Board issued an Order reopening the record for new evidence regarding the Staff's analysis of sites alternate to the Perkins site. We will issue a Decision on this matter at a later date.

8. Environmental Monitoring

50. The Applicant has submitted to the Staff a preoperational monitoring program. (ER, §6.1). The program has been reviewed and approved by the Staff. (FES, §6.1.3; Tr. 670-72, 1132-33). The Board has reviewed the revised preoperational monitoring program and finds that the program is adequate. The Applicant has described an ecological monitoring plan from the present until the first unit goes into commercial operation. (ER, §6.2.5; Tr. 427). The Staff has reviewed such plan and believes it is adequate to establish a baseline for operational monitoring after the plant goes into operation. (Tr. 427, 670-72, 1132-33). The Board so finds.

B. MATTERS IN CONTROVERSY

Detrimental Effects on Recreational and Property Values at High Rock Lake and on the Yadkin River

51. Intervenors; Contention III(A)1 provides:

"III(A) The affects upon Petitioners and others of the consumptive water loss of up to 112 cfs and the proposed drawdown limitation of 880 cfs resulting from the operation of the Perkins Nuclear Station are so adverse as to make the site and design for the plant unsuitable for the following reasons:

"1. The summer months are both the period of Applicant's system-wide peak loads and also the period of maximum recreational use of High Rock Lake. Since Perkins is intended as a base-load plant, it will be operated as close to 100% capacity as possible during those summer months. Consequently, the level of High Rock Lake will drop two feet below normal by September 15 nearly every year the Station operates at full power during summer. As a result the area of the reservoir will be decreased by a maximum of about 1,000 acres, more mud flats, stumps and rocks will be exposed making swimming less desirable and increasing boating hazards. Members of the Yadkin River Committee and other residents and users of High Rock Lake fought for over twenty years to achieve the maximum drawdown conditions presently imposed upon the operating license of High Rock Lake (Yadkin, Inc.). To permit the Applicant to consume up to 112 cfs from the Yadkin River during the summer months would deprive Petitioners and thousands of other North Carolinians of their accustomed recreation and reduce the property values of members of the Yadkin River Committee and other lakeside landowners by millions of dollars."

52. Intervenors' assertion that, during the recreational season Perkins will cause the water level to drop two feet below the usual level, thereby adversely affecting recreational and property values, was based on a statement in the FES at p. 5-4. It is now apparent that the statement was incorrect; it failed to take into account the "rule curve" which governs the release of water from the lake. The error by the Staff was corrected during the course of the hearing.

53. By way of background, the High Rock Lake Impoundment is approximately 31 miles downstream from Perkins (ER, Figure 2.1-1) and was built in 1927 as the uppermost of a series of hydroelectric projects. Yadkin, Inc., a subsidiary of Alcoa, operates the Impoundment under a Federal Power Commission license which imposes minimum release limits on the Impoundment. In 1968, the FPC amended that license to require Yadkin, Inc., to use a "rule curve" in releasing lake water. (Applicant's Water Use Report ("WUR") at WUR-III-2, following Tr. 523; see also 39 FPC 396). The rule curve does not limit the lake elevation to a maximum drawdown. Rather, it limits the production of power before and during the recreational season of May 15 to September 15 in order to preserve, with a high degree

of confidence, the lake level. It accomplishes this end by imposing restraints on the volume of water that can be discharged through the High Rock Lake Dam. (Tr. 539, 588-89; WUR-III-2, following Tr. 523). As a result of the rule curve, the maximum drawdown during the recreational season would be limited to five feet or less, 96% of the time. (Tr. 597; WUR-III-2, following Tr. 523). During 4% of the time, the drawdown could exceed five feet; indeed, the testimony showed that the drawdown during this limited period could approach ten feet. (Tr. 597).

54. The NRC Staff testified that the two-foot figure appearing in the FES at 5-4 was too pessimistic, since it did not reflect application of the rule curve on the drawdown levels of High Rock Lake. (Tr. 1077-78). The Staff stated that the FES calculation was based on the worst case that could be assumed, i.e., merely subtracting Perkins consumptive loss from the High Rock Lake level and without factoring in the rule curve adjustment using the worst year. (Tr. 1075-76). Staff witness presented a supplemental and more sophisticated study which applied the rule curve, covered the recreation seasons from 1968 to 1975, and assumed a 100% capacity factor at Perkins. (Staff Testimony of R.C. Robertson, following Tr. 1062, Tr. 1092). The Staff witness emphasized

that the application of the rule curve, in its revised study was most significant inasmuch as it has such a powerful influence on lake levels that the water consumption upstream of High Rock Lake makes very little difference if the rule curve is rigorously applied. (Tr. 1087-88). In this regard, the Staff found that in the worst year of the study in terms of low flow conditions, 1971, Perkins would have contributed 6 inches to the total drawdown, which was already at four feet. (Staff Testimony of R.C. Robertson, at p. 2, following Tr. 1062). In the Staff's opinion, this additional amount will not have a major impact on recreational use of the lake. (Staff Testimony of R.C. Robertson, at pp. 3-4, following Tr. 1062).

55. Applicant's testimony is in agreement with the Staff's. (Applicant's Testimony of L.C. Dail, following Tr. 275). The basis of such testimony is Applicant's study utilizing 880 cfs base flow which shows, for the recreation season in each year from 1952 to 1971, the maximum drawdown of the lake (a) without Perkins, (b) with Perkins operating at 76% capacity, and (c) with Perkins operating at 88% capacity. The results of the study, set out in

Table 12 of Applicant's Water Use Report (following Tr. 523), show that Perkins would have had an insignificant effect on High Rock Lake drawdowns. Perkins would have had absolutely no effect on lake levels for 15 of the 20 years of the study. In three of the five years of Perkins operation at a 76% capacity factor, the additional amount of drawdown would have been negligible: 0.1 inch, 1.6 inch, and 2.2 inches. In the other two years, it would have an additional drawdown of 7.9 inches and 18.6 inches, but during those years the lake was drawndown to such an extent (6.7 feet in 1954 and 9.8 feet in 1956) that even without Perkins recreational use of the lake would be curtailed. (WUR-VI-2, following Tr. 523). It should be noted that Applicant's study reflects conservative factors. First, the study period includes the driest water year of record, 1956, and the worst drought period of record, 1954 to 1956. Second, it does not reflect the effect of the upstream W. Kerr Scott Reservoir prior to 1962, which would probably serve to maintain a higher stream flow during dry periods due to maintaining minimum releases. (Applicant's Testimony of L.C. Dail, at pp. 11-13, following Tr. 275; WUR-VI-1-2, following Tr. 523).

56. Consistent with the above-referenced testimony and studies is the testimony of Mr. George Popovich. Mr. Popovich, an employee of Alcoa, helped develop the operating guide for the High Rock Lake Impoundment, which is the basis for rule curve limits the FPC imposed in 1968. (Testimony of George Popovich at pp. 1, 3-5, following Tr. 287). In addition, he conducted his own independent analysis of Perkins' impact on the drawdowns at High Rock Lake which shows that Perkins will only add 1/10th of a foot to the drawdown at the lake 98% of the time. (Tr. 549, 576-77, 591). He stated that he believes a tenth of a foot difference in elevation will not be discernable. (Tr. 549). It is important to note that the methodology he used was completely his own and the majority of the information relied upon was developed by him.(Tr. 577). While Mr. Popovich was called by Applicant he stated that he received no direction from them with respect to the nature of his study nor was he paid by Applicant to testify in the proceeding. (Tr. 577, 581).

57. Mr. Popovich's study considered a data base of 49 years (Tr. 589-90) and used adverse meteorology. (Tr. 558). The study's results, as discussed above, were in

agreement with Applicant's analysis of Perkins' impact on High Rock Lake. (Tr. 586-87). However, Mr. Popovich noted that Applicant's model was somewhat conservative in that it did not consider Yadkin, Inc.,'s secondary downstream storage reservoirs which at times would be called on to generate power. (Tr. 586). In addition, Applicant assumed passage of water to generate maximum generation at High Rock Lake permitted by the rule curve. This is conservative since low flows can sometimes be anticipated and adjustments made to generation of energy. (Tr. 586; see also Tr. 531, 549). Mr. Popovich stated that his own model was likewise conservative in that he deliberately made assumptions that overemphasized critical situations. (Tr. 582).

58. We have received conflicting testimony concerning the effect of the drawdown on property values. Intervenors' witnesses concluded that the operation of Perkins would adversely affect property values by reducing the lake level. (Intervenors' Testimony of David Springer, following Tr. 1305; Intervenors' Testimony of Lawrence Pfefferkorn, following Tr. 1286). Applicant's witnesses testified that property values would be unaffected; that even a four-foot drawdown would not significantly affect property values. (Tr. 1171-72).

We consider the argument between parties is irrelevant since there is no evidence that the operation of Perkins will appreciably affect the lake levels.

59. Intervenors have not presented any testimony that would demonstrate that withdrawal of water by Perkins will appreciably affect the lake level. They argue that withdrawals by Perkins will reduce the amount of hydropower available to Alcoa; that economic self-interest will cause Alcoa to deviate from the rule curve which will result in a lowering of the lake level. (Intervenors' Proposed Findings, p. 7). We reject such arguments. Our finding that withdrawal of 100 cfs from the Yadkin River will not lead to unacceptable consequences is based in a large measure, on the continued application of the rule curve. A change in the rule curve would require a re-evaluation of the impact of Perkins.

60. On the basis of the above facts, the Board finds that Perkins' use of Yadkin River water will have a negligible impact on High Rock Lake drawdowns. Since the effect on drawdowns is negligible, the effect on recreation and property values should also be negligible.

Further Development in
the Yadkin River Basin

61. Intervenors' Contention III(A)2 follows:

"2. Both the Applicant and Staff have radically underestimated the affect of the proposed 880 cfs drawdown limitation upon the future water needs of the Yadkin River Basin. The Staff has admitted that 'if the future water needs for the river grow significantly, critical water shortages could develop.' In its 1974 Third Annual Report, the official North Carolina state government Council on State Goals and Policies estimates the population of the Piedmont area of North Carolina (roughly the ea traversed by the Yadkin River) will in- crease by almost 55% from 1970 to 2000, approximately one half of the way through the life of the plant.

"The possible daily consumptive loss of 112 cfs of water represents 10 times the daily consumptive loss from the entire City of Winston-Salem, and the amount of water necessary for the operation of the PNS would support a domestic-industrial complex of over four million people.

"The operation of the Perkins Nuclear Station under the 880 cfs maximum drawdown limitation proposed by the Applicant and accepted by the Staff will result in one or both of the following:

"a) Significant inhibition of future municipal and industrial growth both upstream and downstream from the plant.

"b) Critical water shortages during periods of low flow."

62. Intervenors argue that Perkins consumptive water loss will significantly inhibit future growth both upstream and downstream from the plant and cause critical water shortages during periods of low flow. Intervenors' case in this regard consists chiefly of the testimony of David Springer (Tr. 1305), two exhibits,[8/] plus extensive cross-examination of Applicant's witness Dail. (Tr. 893-997). Mr. Springer's testimony included a table which was taken from a report of the North Carolina Department of Natural and Economic Resources, (Exhibit 5), showing the projected fructuary uses of the Yadkin River Basin for the years 1990, 2000, and 2010. It indicated that the amount of water used would increase from 170 Mgd[9/] in 1970 to 628 Mgd in 2020. Mr. Springer also presented data on minimum flows in the Yadkin River. There have been occasions when the flow has been as low as 260 Mgd (The 7Q10 flow is 725 cfs or 468 Mgd - Springer, p. 9). Thus, although the average flow of the river is 2700 cfs, he argues that there will be periods when the river flow is inadequate for future needs; that an additional consumptive use of 100 cfs (65 Mgd) by Perkins should not be permitted.

8/ Intervenors' Exhibits 5 and 6 admitted into evidence at Tr. 1326.

9/ Mgd is an abbreviation of millions of gallons per day.

63. Applicant argued that the needs of present and potential users of the Yadkin River can be satisfied even during periods of low flow. Witness Dail sponsored a document entitled "Water Use Report," (abbreviated WUR) which projected the total withdrawals of water from the Yadkin River for each county within the Yadkin River Basin in the decades from 1970 to 2020 (WUR, Table 8, following Tr. 523). Withdrawals for 1970 totaled 152 Mgd (235 cfs); for 2020 the projected total was 380 Mgd (590 cfs). The figure for 1970 (152 Mgd) is somewhat smaller than that of Intervenors' witness (170 Mgd) but the projected figure for 2020 (380 Mgd) is much less than Intervenors' figure (628 Mgd). Applicant based his future requirements on estimated population growths. Since the average Yadkin River flow is 2880 cfs the consumptive withdrawal of 100 cfs by Perkins would still leave plenty of water for other uses.

64. Applicant, however, admitted that with minimum flows as low as 177 cfs and 7Q10 flows of 625 cfs that some measures must be taken at times of low flow. They proposed the construction of Carter Creek Impoundment which will store enough water to supply the consumptive requirements of Perkins for about 100 days (L.C. Dail, at pp. 9-11, following Tr. 275). They proposed no net withdrawals of water from

the Yadkin when the river flow was less than 880 cfs. Thus downstream users needs (projected at 232 Mgd or 360 cfs) would be met except for extended drought periods and would not be affected by Perkins' operation.

65. The Staff did not make an independent estimate of future demands on the Yadkin River and have submitted no proposed findings regarding this contention. The FES (§5.2.1) points out that the operation of Perkins will increase the frequency at which flows below 880 cfs will occur.

66. The State of North Carolina pointed out that the State has long been vitally interested in the development of the Yadkin River Basin - that they planned to hold hearings on the use of water from the Yadkin in connection with the application of Duke Power for a certificate. Since such proceedings were imminent the State requested that their presentation of evidence in this proceeding be deferred until such time as the State had resolved the matter to its satisfaction. The Board granted the State's request. (See Board Order of April 15, 1976).

67. On April 28, 1977, the State of North Carolina introduced into the record of this proceeding two documents which describe the action of the State. State Exhibit 1 was a copy of an order by the North Carolina Utilities Commission (NCUC) granting a "Certificate of Public Convenience and Necessity" to Duke Power authorizing the construction of Perkins. State Exhibit 2 is a copy of Environmental Management Commission (EMC) corrected Resolution No. 76-41. In that document EMC found that the effects of Duke's withdrawal on downstream users will be minimized if the net withdrawal is limited to no more than 25% of stream flow and is prohibited when stream flow is 1000 cfs or less. The maximum consumptive withdrawal is not to exceed 112 cfs. These conditions were made a part of the certificate from the NCUC.

68. Raising the limiting stream flow from 880 cfs to 1000 cfs will further minimize the impact of Perkins on downstream users. We find that with such a restriction the adverse affects of consumptive use of water by Perkins will be minimized and is a tolerable impact in view of the benefits of the power produced. We adopt the conditions imposed by the State of North Carolina.

Loss of Hydroelectric Power

69. Intervenors' Contention III(A)3 follows:

> "3. The Applicant and Staff have only considered the loss of downstream hydroelectric generating capacity from existing generating facilities and have ignored the potential loss of capacity from future hydroelectric generating facilities."

70. Applicant testified that the Corps of Engineers has conducted a cost-benefit analysis of potential hydroelectric sites and found them economically unjustifiable. (Testimony of L.C. Dail, at p. 13, following Tr. 275).

71. Intervenors offered no direct testimony in support of their contention. There will be a loss of hydroelectric power from present facilities downstream of Perkins. Intervenors questioned one of the Applicant's witnesses concerning the accuracy of the dollar estimates for loss of hydropower, (Tr. 570-576) but this Board believes that matter has been adequately considered by the Staff and the Applicant. (FES, §5.2.1.4; ER, §3.3.1).

72. Intervenors filed no brief in support of their contention. Neither did the Staff. The contention remains unsupported.

Eutrophication and Fish Kills

73. Intervenors' Contention III(A)4 follows:

> "4. The operation of the Perkins Nuclear Station with a consumptive water loss of up to 112 cfs and an 880 cfs drawdown limitation will contribute to and hasten eutrophication of the High Rock Lake. It will further increase the frequency and and severity of fish kills."

74. The Yadkin River and High Rock Lake are at present badly polluted as a consequence of municipal and commercial discharges into the river. Fish kills and other signs of eutrophication are particularly evident during times of low flow. The consumptive withdrawal of 100 cfs of water and the addition of some chemicals by Perkins will contribute to a reduction in water quality in the river and lake. However, the requirement that Perkins make no net withdrawals when the river flow is less than 1000 cfs will be an important factor in limiting the adverse effects of Perkins on the water quality.

75. Intervenors argue that Perkins will contribute to and hasten eutrophication of High Rock Lake and will further increase the severity and frequency of fish kills. In support

of their contention, Intervenors offered two witnesses, Mr. David Springer (Testimony following Tr. 1305) and Mr. Lawrence Pfefferkorn (Testimony following Tr. 1286). Mr. Springer, who has lived for many years on the river and Mr. Pfefferkorn, who is also personally acquainted with High Rock Lake since it was built in the 1920's -- both testified to the steadily deteriorating quality of the water. Neither witness claimed any expertise in the field of biology or aquatic ecology. Neither attempted to show any specific effects of Perkins on water quality or frequency of fish kills.

76. As to fish kills, Applicant testified that such have been caused in the Yadkin River by (1) insufficiently treated sewage discharged from the City of Winston-Salem, (2) effluents discharged from finishing plants near the headwaters of High Rock Lake, and (3) algae bloom, a blue-green algae, which during nights started respiring, used up the oxygen, and the fish died from lack of oxygen. (Tr. 1203). Applicant testified that Perkins' discharge, either in terms of chemical or thermal emissions, will not interact with the sewage from Winston-Salem or the finishing plant discharges and exacerbate the fish kill. (Tr. 1205).

With respect to the algae bloom, Applicant testified that the general low light penetration due to high turbidity in the Yadkin effectively inhibits the development of the bloom. (Tr. 1205).

77. Applicant stated that the only nutrient discharged from Perkins that would contribute to the explusion of the biomass would be phosphorous. (Tr. 1209). However, phosphorous poses no problem with respect to eutrophication at High Rock Lake in that the maximum discharge is estimated to cause only a 1% increase in the total phosphorous content of river and lake water. (Tr. 1207; 1219-20). Applicant also testified that the oxidation of water caused by Perkins will actually help to increase the quality of the Yadkin River water. (Tr. 1212-13, 1219-20).[10/]

10/ It should be noted that Applicant has obtained a 401 Certification from the State of North Carolina pursuant to the Federal Water Pollution Control Act, as amended, which provides that any discharge from Perkins will comply with the applicable provisions of Sections 301, 302, 306, 307 of the Act. See Applicant's Exhibits 3A and 3B admitted at Tr. 293).

78. The Staff testified that Perkins will have little or no effect on eutrophication at High Rock Lake. (Testimony of Benjamin R. Parkhurst at pp. 2-3, following Tr. 1099). He based this conclusion on the fact that Perkins will add only small amounts of phosphorous to the Yadkin River. (Id.).

79. As to the probability of Perkins increasing the frequency and severity of fish kills, the Staff found such to be small because of the several mitigating factors also testified to by Applicant above. (Testimony of Benjamin R. Parkhurst at p. 4, following Tr. 1096).

80. The Board finds that the testimony of Staff and Applicant biologists is probative and convincing; that the operation of Perkins will not significantly add to the eutrophication of High Rock Lake or appreciably add to the fish kills.

Need for Power

81. Intervenors' contend in their Contention III(E):

> "E. The Perkins Nuclear Station will not be needed at the time the facility is scheduled to come on line for the following reasons among many others:

"1. The applicant's forecasts of future peak demand are inadequate and inaccurate.

"2. The applicant's forecasts of future peak demand do not adequately take into account the effects of negative price elasticity, advances in alternatives energy sources, and other methods of energy conservation.

"3. The North Carolina General Assembly passed a bill in the 1975 session allowing the North Carolina Utilities Commission to adopt peak-load pricing as an incentive to load staggering."

82. Applicant presented testimony which included projections of its peak loads, generation additions with date of commercial operation, system capability, and reserve percentages. Those projections are:

Peak Period	Forecast Peak Load	Unit Additions	Date of Commercial Operation	System Capability	Percen Reserv
1977 Summer	9,523			12,456	30.8
Winter	9,510			12,456	31.0
1978 Summer	10,163			12,456	22.6
Winter	10,235	McGuire 1	1-1-79	12,456	21.7
1979 Summer	10,820			13,636	26.0
Winter	11,053	McGuire 2	1-1-80	13,636	23.4
1980 Summer	11,645			14,795	27.0
Winter	11,884			14,795	24.5
1981 Summer	12,337	Catawba 1	7-1-81	14,795	19.9
Winter	12,685			15,948	25.7
1982 Summer	13,059			15,948	22.1
Winter	13,506	Catawba 2	1-1-83	15,879	17.6
1983 Summer	13,810			17,032	23.3
Winter	14,352	Cherokee 1	1-1-84	16,804	17.1
1984 Summer	14,589			18,084	24.0
Winter	15,220	Perkins 1	1-1-85	17,823	17.1
1985 Summer	15,400			19,103	24.0
Winter	16,112			19,010	18.0
1986 Summer	16,243	Cherokee 2	7-1-86	19,010	17.0
Winter	17,019			20,290	19.2
1987 Summer	17,122	Perkins 2	7-1-87	20,290	18.5
Winter	17,943			21,570	20.2
1988 Summer	18,037			21,570	19.6
Winter	18,883	Cherokee 3	1-1-89	21,570	14.2
1989 Summer	18,974			22,850	20.4
Winter	19,825	Perkins 3	1-1-90	22,850	15.3
1990 Summer	19,943			24,130	21.0

(Applicant's Testimony of D. H. Sterrett, Attachment 1, following Tr. 1491)

83. These projections were developed by Duke using past experience as the basis for its conclusions. Two fundamental components of its peak load were considered: the baseload component and the temperature responsive component which were identified by means of an equation explained by Applicant's witness Beyer.(p. 9, following Tr. 268). After the two components were identified they were independently subjected to a trending technique thought by Duke to be appropriate. The peak load was then computed by adding the components. The result was checked by comparisons with independent information, such as other forecasts, known marketing information, and the like.(Id., p. 10). Price elasticity was not used in forecasting but Duke is investigating the use of econometric modeling as an additional help in forecasting because of the rather large price increases that occurred in 1974 and 1975 as compared to the comparatively small changes that had been previously experienced. A second reason is the current interest in peak load pricing.(Id., p. 11). This technique has been suggested by Duke to the State but has not been implemented. (Tr. 1525).

84. Since 1970, Duke's peak loads have changed as follows:

Peak Load		Increase Over Previous Year
1970	6284 MWe	11.9%
1971	6622 MWe	5.4%
1972	7450 MWe	12.5%
1973	8236 MWe	10.6%
1974	8058 MWe	(2.2%) decrease
1975	8422 MWe	4.5%

The 1974 decrease and the 1975 comparatively small increase were attributed by Duke to the then current energy "crisis" and the recession. A recovery economy, Duke believes, will bring a return to more traditional trends. (Beyer, p. 2).

85. The North Carolina Utilities Commission forecast a 6.90% growth in peak load until 1986 and 6.85% thereafter until 1990. (State Exhibit 1, p. 8). These forecasts were preceeded by public hearings which Intervenors here and others appeared to present evidence. The hearings resulted in the issuance of a Certificate of Public Convenience and Necessity in which the NCUC said that: "Public Convenience and Necessity mandates that the Perkins and subsequent plants be constructed as scheduled by Duke." (See State Exhibit 2, p. 11).

86. The NRC Staff agrees. The Staff's projection is for Duke's growth in peak load to be a 6.5% to 7.0% average compound rate until 1990. (Cleary, following Tr. 456, p. 8). These rates would result in reserve margins until 1990 of from 20% (for some 6.5% growth rate years) to a -4.0% if the growth rate averages 7.5%. Reserves in the low to mid 30.0% range would result if growth averages 5.5% and the construction schedule is not slipped. (Id., p. 43). The Staff thinks a reserve margin of 30% on Duke's system is reasonable and that 15% is too low. (FES, §8.3.1).

87. The Intervenors presented the testimony of two witnesses. Dr. Miles O. Bidwell, an Assistant Professor of Economics at Wake Forest University, criticized the demand projections of Duke because the Duke methodology assumed that people would increase their use of electricity in the future because they have done so in the past. A better method, according to the witness, would be to try and explain what determines how much electricity people will use. When that has been determined, modern econometrics could be used to measure the effect of changes in these variables on electrical consumption. The next step would be to project the changes in

the variables and from that to predict future electrical demand. (Tr. 419). The witness has studied the behavior of Duke system customers for 20 years and has determined that the major factors which effect electrical demand are per capita income, the price of electricity, the price of substitute energy, and the price of electrical appliances. One of the variables having the most effect on conservation is price. In the sixties, the price of electricity declined in relation to real prices so that consumption went up. Dr. Bidwell believes that following and predicting such changes in price would be a more useful tool for the prediction of peak load than would following past trends. The witness has worked out three equations for the prediction of residential demand and one equation each for the prediction of commercial and industrial demand; those equations are a part of and explained in his testimony. (Tr. 419 et seq and attachment). Dr. Bidwell believes that there is no basis for Duke's projections and that depending on what happens to per capita income and to price increases in electricity in the next ten years there may be no increase in total demand. (Tr. 425). Dr. Bidwell also spoke to peak load pricing. He noted that Duke uses only about

one-half of its generating capacity on an average. Under a different pricing system, demand would even out and Duke could double the amo· t of power they generate with no new capacity. (Id.).

88. Dr. Bidwell has not made any projections into the future but his techniques fit history for the 20 years ending in 1974. (Tr. 428). He feels the failure of Duke to use econometrics causes its projections to be severe over-estimates. He has not been able to make projections because of lack of time and money. (Tr. 444).

89. Intervenors' second witness on their Contention III(E) was Mr. Jesse L. Riley, a Senior Research Associate with Celanese Fibers Company and the holder of a B.S. in Chemistry and Physics and an M.S. in Physical Organic Chemistry. Over the past few years, Mr. Riley has extensively studied utility economics and load forecasting and has testified as an expert on that subject in NRC proceedings; he has addressed and advised other groups in that field. (Riley, p. 1, following Tr. 795).

90. Mr. Riley said that for many years, Duke's projections of peak load were accurate, but that since 1971, Duke predictions have been high. (Riley, pg. 2). The reason for the failure to accurately predict in recent years, is that the projection methods are archaic. He suggest an econometric projection with the "crux" being an adverse relationship between constant dollar costs of electricity and demand. There is a correlation, says Mr. Riley, of base load with constant dollar cost to the consumer, a "negative elasticity." (Id., at 4). Various approaches to Duke's load over the past few years contradict Duke's trend method of projection because the latter method ignores recent history. The 7-8% increase projected by Duke is short-run behavior. (Id., at 6). Duke has also failed to consider the effect of escalation in nuclear fuel cost and its impact on "negative elasticity." (Id., at 9).

91. Mr. Riley believes that Duke's projections are too inadequate a basis to support a decision to build Perkins. The result of possible power shortages are not substantial. He suggests that at worst, Duke might have to delay retirement of capacity or run at reduced voltage for short periods. This is a less risky outlook than to ignore the "strong

indications" that the vast amount of money spent for Perkins will inflate the cost of electricity enough to further depress demand through the effect of negative elasticity. (Id., at 13). Mr. Riley provided no projections of his own.

92. Events, since the testimony was received, have lent strength to the view that Duke's projections have been high. Early this year, Duke served on the Board and parties a notice that two of the Perkins units have been delayed 3 years and one has been delayed 4 years.[11/]

93. We are not convinced, however, that this circumstance outweighs the evidence in the record of the long-term trend in demand produced by Duke, Staff, and NCUC. These projections

---

11/ In a comment to Duke's notice, the Staff indicates that Duke's delayed construction schedule reflects a drop in demand of about 0.6% according to Duke projections and a 1990 peak demand of 861 MWe less than the Staff's projection (filing of March 8, 1978). That reduction is in the range of changes in demand projections characterized by the Appeal Board in Consumers Power Company (Midland Plant, Units 1 and 2), ALAB-458, 7 NRC 155 (1978) and Niagara Mohawk Power Corporation (Nine Mile Point, Unit 2), ALAB-264, 1 NRC 347 (1975), as within the "substantial margin of uncertainty" that attends forecasting of power demands. We do not believe it necessary to re-open the record to re-examine the new projections.

square well with the list of studies published by FEA in 1976 and which are set out in Staff's testimony. (Cleary, following Tr. 456, p. 4). We note also the inclination of this Commission to prefer historical trending techniques to econometrics discussed by the Appeal Board in Nine Mile Point.[12/]

94. We find that Duke and the Staff have proved the need for the Perkins facility.

C. BOARD QUESTIONS ON ENVIRONMENTAL IMPACT OF PERKINS

Timing of Perkins Units with Respect to Cherokee

95. By letter of March 8, 1977, the Board asked Applicant and Staff to address the feasibility of deferring all Perkins units until all Cherokee units might be completed rather than planning to introduce into service each Perkins unit alternately with a Cherokee unit.[13/] The purpose of the question was to determine whether a delay in Perkins might be beneficial in

---

12/ Niagara Mohawk Power Corporation (Nine Mile Point Nuclear Station, Unit 2) ALAB-264, 1 NRC 347 (1975).

13/ Duke's revised construction schedule issued January 9, 1978, shows an operational date for Perkins' first unit to follow Cherokee Units 1 and 2.

allowing a further study of Duke's lessening demand and a delay in the environmental damage to be done by the construction and operation of Perkins. (Tr. 1658). Applicant's response to the question appears in a letter from Duke's Mr. Dail to the Staff dated April 13, 1977, and in Mr. Dail's testimony.(both following 1661). The Staff's response appears in the form of prefiled testimony and cross-examination on that testimony. (Both following Tr. 1560). It appears that a delay in Perkins construction and an attendant acceleration in Cherokee construction will result in a substantially higher cost for Perkins due to a projected escalation in the cost of construction and a modest decrease in the cost of Cherokee due to earlier construction of some units. This stated disadvantage to a delayed Perkins schedule does not consider the cost difference in constant (as opposed to inflated) dollars; what the real cost difference may be does not appear from the testimony of either Applicant or Staff.

96. An additional cost would result from an inbalance of the location of generation on the Duke transmission system. This would result, Duke says, in a minimum of $50 million spent for beefing up transmission lines "a significant part" of which

would "probably" not be needed when Perkins is built. Another disadvantage to this plan is that a larger work force is needed at each site while construction there is accomplished. This results in less efficient management of the work force, more competition for skilled workers at the work locations, more strain on access facilities, and added pressure on community services.

97. There would be an advantage to the delay of Perkins until Cherokee comes on line only if it is determined now that Perkins will not likely be needed during the time that we deal with here. In another part of the decision we have found a need for the Perkins plant; to delay its beginning until Cherokee is finished would provide no benefit.

98. The Board by letter dated March 15, 1976, directed certain questions to the Staff respecting matters contained in the Final Environmental Statement. The Staff responded in detail thereto. (Testimony of Robert A. Gilbert, following Tr. 1227 and following Tr. 1336; Tr. 1228-49; 1337-41). The Board questioned some of the answers that was provided in the written testimony and deems that the Staff's responses were satisfactory. One of our questions precipitated an argument between Applicant and Staff counsel concerning the authority of NRC to impose a condition requiring an approved erosion

control plan prior to start of construction. (Tr. 1230-35). Applicant's Brief, dated June 23, 1976, argues that Section 402 of the FWPCA grants sole authority to regulate pollution to EPA. The Board declines to be drawn into this argument. We note that the Applicant has agreed to send NRC a copy of their erosion control plan in accordance with Staff proposed Condition 7b, FES, p. iii; however, they argue that approval by the NRC Staff is not necessary. Only in the event that the Staff were to turn down the proposed plan would adjudication be required.

D. COST-BENEFIT ANALYSIS

99. In accordance with the Commission's Rules and Regulations and Notice of Hearing published in the Federal Register on July 19, 1974, (39 Fed. Reg. 26470), this Board has independently considered the costs and benefits of the proposed facilities upon the basis of the evidence of record and has arrived at an overall cost-benefit balance.

100. Most of the testimony submitted by the parties in this proceeding was directed toward the environmental impact of the Perkins plant. We take note of the Staff's summary of adverse impacts listed in Chapter 10 of the FES. The Intervenors have called to our attention those impacts that they consider to be most serious and we have addressed them

in previous sections of this decision. We have made an independent analysis of the evidence and find that the principle environmental costs are as follows:

(1) The clearing and grubbing of approximately 1700 acres of predominately forested and semi-forested land for the plant site, Carter Creek Impoundment, transmission line and railroad spur.

(2) The withdrawal of 1500 acres of land from agricultural production.

(3) The possible disturbance of 2000 acres of arid western lands due to open-pit mining operation in connection with supplying uranium to the Perkins plant for 30 years of operation.

(4) The escape of radon-222 into the atmosphere as a consequence of mining and milling operation. This will increase the radon background by a small fraction of one percent.

(5) Withdrawal of 60,000 GPM (133 cfs) maximum, 42,000 GPM (94 cfs) average, from the Yadkin River for cooling tower make-up.[14/] During times of low flow

---

14/ Applicant's Water Use Report Table 1.

(7Q10 flow = 625 cfs) up to 20% of the entrainable river organisms will be destroyed. On the average over a year some 3% of the organism will be entrained and presumably killed.

(6) The consumptive withdrawal of up to 100 cfs from the Yadkin River. The reduction in the capacity of the river to assimilate wastes is a serious consideration but is tolerable in view of the limitation on net withdrawal when the river flow is less than 1000 cfs.

(7) Perkins will be a very minor contributor to fluctuation in the level of High Rock Lake.

(8) Reduction of flow to hydrostations downstream will result in an economic loss to the owners; not an environmental impact.

(9) Small amounts of radioactivity will be released during normal operation. The dose to individuals will be very small compared to background. Even if an accident resulting in considerable damage to the reactor were to occur, doses to the public would be

small since the reactor and primary systems are within the containment vessel. Failure of the containment is considered by the Staff to be so improbable that the risk to the public is negligible. We have not made any attempt to quantify the risk but we do not believe it to be so large as to tip the cost-benefit balance.

101. The Board finds that the principle benefit of the proposed project is the addition of 25.57 million megawatt hours per year of electricity which is needed to provide reliable electric service to residential, commercial, and industrial users in Applicant's service area and grid.

102. Based on the entire record, the Board finds that the environmental and economic benefits from the construction of Perkins Units 1, 2, and 3 will be greater than the environmental and economic costs which will necessarily be incurred by construction and operation of the facilities.

103. The Board cannot find that the balance between the benefits and costs involved in the construction of Perkins Units 1, 2, and 3 warrants granting the construction permits for the facilities since it has determined that further consideration must be given to alternate sites. The Board cannot find on the record to date that the requirements of NEPA and 10 CFR Part 51 have been met.

III. RADIOLOGICAL HEALTH AND SAFETY FINDINGS

A. BASIC FINDINGS

104. On May 24, 1974, the Commission docketed the Applicant's Preliminary Safety Analysis Report (PSAR).[15/] The PSAR contains a description and safety assessment of the site and the preliminary design and analysis of all of the facility's components and structures except for the nuclear steam supply system which has been designed by Combustion Engineering Corporation. That part of the system is described in the CESSAR and was incorporated by reference in the PSAR in accordance with Appendix O to 10 CFR Part 50. The PSAR includes a discussion of the compliance with the Commission criteria of 10 CFR Parts 20 and 100 and those criteria of 10 CFR Part 50 for which the Applicant was directly responsible. The PSAR also describes the Applicant's proposed organization, technical and financial qualifications, and preliminary plans for training of personnel and conduct of operations.

15/ The PSAR (with amendments and the License Application, with amendments) were received into evidence as Applicant's Exhibit 2 at the hearings held on April 26, 1976. (Tr. 266).

105. The Staff performed a technical review and evaluation of the information and data submitted by the Applicant in the PSAR and subsequent amendments, the CESSAR, and the interface requirements between the CESSAR and the PSAR. As a result of this review and its own independent analysis, the Staff prepared a Safety Evaluation Report ("SER"), issued in March of 1977, and Supplement No. 1 to the SER ("SER Supp."), issued in July of 1977.[16/] The Staff concluded in that SER that, assuming favorable resolution of the then outstanding matters discussed therein, the facilities can be constructed and operated at the proposed site without undue risk to the health and safety of the public. (SER, §21). In the SER Supplement No. 1 the Staff addressed these outstanding matters and concluded that all outstanding were resolved. (SER Supp., §21) (Tr. 2011).

106. In the SER and the Supplement the Staff analyzed and evaluated the distribution of population and land use offsite, and the physical characteristics of the site including seismology, geology, hydrology, and meteorology. It analyzed and evaluated the design, fabrication, construc-

---

16/ The SER was received into evidence as Staff Exhibit 8 at the hearing held on July 21, 1977. (Tr. 2010). The Supplement to the SER was also received into evidence as Staff Exhibit 9 at that time. (Tr. 2014).

tion, testing, and expected performance of the plant structures, systems and components important to safety, and the response of the facilities to various operating transients and to a broad spectrum of postulated accidents, including design basis accidents. The Staff analyzed and evaluated the Applicant's plans for the conduct of plant operations and plans for actions to be taken in the event of an accident which might affect the general public, Applicant's organization structure and the technical qualifications of operating and technical support personnel, and measures to be taken for industrial security. The Supplement also contains an analysis and evaluation of the financial qualifications of the Applicant to design and construct the facilities.

107. The Board has considered the License Application, the PSAR, and amendments thereto, the SER and the Supplement, and the evidentiary record in this proceeding. We find that the Staff's technical review and safety evaluation have been adequate in nearly all respects. However, in our Order of September 7, 1978, we questioned the adequacy of the evidence on generic safety issues. On September 14, the Staff replied that they proposed to introduce supplemental testimony. Our final findings will be reserved pending the receipt of that testimony.

108. The Advisory Committee on Reactor Safeguards ("ACRS") has reviewed the application for Cherokee and Perkins and has concluded in its letter dated April 14, 1977, that the Perkins units can be constructed with reasonable assurance that they can be operated without undue risk to the health and safety of the public. (SER Appendix C of Appendix A; SER Supp., Appendix D). The Applicant and the Staff have duly considered and are taking appropriate action to implement recommendations of the ACRS. (SER Supp., §18).

General Description of Site and Plant

109. The Applicant and Staff have evaluated the suitability of the proposed Perkins site from the standpoint of radiological health and safety considerations. The evaluation has included a consideration of the reactor site criteria identified in 10 CFR Part 100 of the Commission's Regulations. (PSAR, §2 ; Staff Testimony, following Tr. 407 and 696).

110. The site is located in the southeastern portion of Davie County, North Carolina, approximately seven miles southeast of Mocksville, North Carolina, and forty-eight miles north northwest of Charlotte, North Carolina. (Staff Testimony at p. 1, following Tr. 407).

111. The nearest population center having more than 25,000 people, as defined in 10 CFR Part 100, is the Salisbury-Spencer, North Carolina area, which is centered about 12 miles from the site. The 1970 population of Salisbury and Spencer was about 25,600 people. The 1980 population density within ten miles of the site is projected to be about 135 persons per square mile, and the population density within fifty miles of the site in 1980 is projected to be about 250 persons per square mile. (Staff Testimony at pp. 2-3, following Tr. 407).

112. Applicant's projected population levels for the region within 50 miles, based on projections by the U.S. Environmental Protection Agency, indicate a population growth of about 120% during the period 1970 to 2020, which corresponds to an average rate of about 17% per decade. The Staff independently projected a growth of about 66% by applying the 1974 OBERS[17/] Projections growth rates to the present population in this general area. The Staff concluded

---

17/ OBERS is the descriptive title of a projection program conducted by the U.S. Department of Commerce former Office of Business Economics (OBE), now renamed the Bureau of Economic Analysis (BEA), and the Economic Research Service (ERS) of the U.S. Department of Agriculture.

that the higher population density, as projected by the Applicant will not likely be exceeded over the life of the station, and that population density is not a deterrence to locating the Perkins Nuclear Station at the selected site. (Staff Testimony at p. 3, following Tr. 407).

113. The minimum exclusion area distance proposed by the Applicant is 2,500 feet for the centrally located unit, and 1,960 feet for each of the other two units, and the low population zone radius proposed is five miles. The population center distance of ten miles is well in excess of the minimum distance of one and one-third times the low population zone radius required by 10 CFR Part 100. The Applicant has projected a population growth within the five-mile low population zone from the present level of about 4,500 to about 9,400 by 2020. In addition to the resident population, transient population within the low population zone is estimated to include as many as 3,100. There are two schools within the low population zone about five miles from the site. The Staff conducted its own review and concluded that the population within the low population zone has been appropriately described in the Preliminary Safety Analysis Report. (Staff Testimony at pp. 3 and 4, following Tr. 407).

114. Applicant owns all of the property within the exclusion area. None of the property acquired by it has mineral easements or rights owned or controlled by a second party. The Staff concluded that by owning the property within the proposed exclusion area, the Applicant can provide control of the exclusion area in accordance with the requirements of 10 CFR §100.3. (Staff Testimony at p. 4, following Tr. 407).

115. The Staff has analyzed the five-mile low population zone distance and concluded that appropriate protective measures can be taken to protect the resident and transient population in the event of a serious accident. The Staff has not identified any unusual features for this site which would prevent a favorable conclusion with regard to the feasibility of developing appropriate emergency plans. The Staff concluded that there is reasonable assurance that appropriate and adequate engineered safety features can be provided to meet the radiation dose guidelines values specified in 10 CFR Part 100. (Staff Testimony at p. 6, following Tr. 407).

116. The Board finds that with respect to the minimum exclusion area radius, the low population zone, and the population center distance, the Perkins site meets the guidelines of 10 CFR Part 100 and is acceptable.

117. The nearest industry to the proposed facility is the Williams Manufacturing Company, a manufacturer of women's apparel, located two and two-tenths miles north northeast of the site. The Staff found that this activity will not interact with the plant. A pipeline corridor approximately three miles southeast of the site includes pipelines that carry natural gas and methane. The Staff has investigated the hazards associated with these pipelines and concluded that the pipelines do not pose a significant threat to plant safety. There are no other industrial facilities within five miles of the plant location. (Staff Testimony at pp. 6 and 7, following Tr. 407).

118. The nearest major highway to the proposed Perkins site is North Carolina 801, which passes six-tenths of a mile north and one and one-half miles west of the site. There is adequate separation distance between the road and

the proposed facility to assure that the effects of postulated accidents along the roadway will not adversely affect the safe operation of the Perkins Station. (Staff Testimony at p. 7, following Tr. 407).

119. The Staff performed an analysis of air traffic in the vicinity of the site and found that the aircraft hazards to Perkins are sufficiently low that they do not need to be considered as a basis for design of the principal features of the plant and that with regard to the subject aviation facilities and activities the site is acceptable for reactors of the general size and type proposed. (Staff Testimony, following Tr. 696).

120. The Board has reviewed the evidence and concluded that with regard to nearby industrial, transportation, and aviation facilities, the site is acceptable for reactors of the size and type proposed.

121. The physical characteristics of the site, such as meteorology, geology, and hydrology, have been considered extensively by Applicant and Staff. (SER §§2.3; 2.4; 2.5). The Board finds that such consideration has been adequate.

122. The Board requested and received additional testimony concerning the choice of 0.15g as the safe shutdown earthquake for nuclear plants located in the Piedmont Province. (See Staff Response to Question 8, Cherokee Tr., following p. 954; See Applicant's Testimony, Cherokee Tr. 1034-35; See Also Staff's Testimony Perkins Tr. 2070). On the basis of this record, the Board concludes that 0.15g represents a conservative choice for the SSE.

Design Description, Principal Architectural and Engineering Criteria

123. Perkins incorporates nuclear steam supply systems consisting of pressurized water reactors supplied by Combustion Engineering, Incorporated ("CE") and designated as their System 80 design. On September 17, 1973, CE filed with the then Atomic Energy Commission a proposed preliminary reference system design for System 80. A standard safety analysis report entitled "Combustion Engineering Standard Safety Analysis Report" ("CESSAR") also was submitted to the Commission. The information in CESSAR was supplemented through December 31, 1975, with forty-four amendments. On that date the NRC Staff issued a Safety Evaluation Report which summarizes the results of the Staff's technical evaluation of the System 80 design, and which delineates the scope of the

technical matters considered in evaluating the radiological safety aspects of the System 80 design. Based upon its evaluation of CESSAR, the Staff concluded that the System 80 design can be incorporated by reference in applications for construction permits and can be constructed without endangering the health and safety of the public. See 10 CFR Part 50, Appendix O. The Safety Evaluation Report for the System 80 design is attached as Appendix A to the Perkins SER. The CESSAR was incorporated by reference into the PSAR.

124. Each Perkins unit will be designed for a power level of approximately 3800 megawatts thermal and a net electrical output of 1280 megawatts electric. (SER, Appendix A, §1.2). Water will serve as both moderator and coolant, and will be circulated through each reactor vessel and core by four reactor coolant pumps. (SER, Appendix A, §1.2.2). Each reactor has 241 fuel assemblies in its core with a 16 x 1[illegible] fuel rod array. (SER, Appendix A, §4.3). Fuel pellets of 95% density uranium dioxide will be sealed in Zircalloy-4 tubing and pressurized with helium to form the fuel rods. Neutron absorber rods (boron carbide) will be provided in

place of fuel rods at selected locations in the fuel assemblies. Each fuel assembly will be provided with a threaded joint tc allow the attachment of upper and lower end fittings to the guide tubes so they may be removed to allow replacement of individual fuel rods. (SER, Appendix A, §4.2.1).

125. Each unit will be housed in a spherical steel containment vessel surrounded by a reinforced concrete shield building that is a cylindrical shell with an upper spherical dome closure. The vessel and the spherical portion of the shield building will be separated by an annular air space. The containment will be designed for an internal pressure of 46.8 pounds per square inch gauge ("psig") and for a temperature of 280°F. (SER, §6.2.1). The containment pressure calculated by the Applicant for the worst design basis accident was about 43 pounds per square inch gauge. (SER, §6.2.1).

126. The containment houses the reactor, steam generators, reactor coolant pumps, and pressurizer. The shield building (also called the reactor building in the PSAR) contains certain components of the engineered safety features systems for the

facilities including the emergency core cooling system equipment, containment spray system equipment, and shutdown cooling system equipment. (SER, §§1.2.2 and 3.8.1 and Fig. 1.1; PSAR Figures 1.2.1). An auxiliary building immediately adjacent to the shield building includes areas for fuel handling, auxiliary systems equipment, and the control room. (SER, §1.2.3). Other major structures for each unit include the two individual buildings for the diesel generators (SER, §8.3.1), the turbine building, and the three circular mechanical cooling towers. Each of two nuclear service water pump structures, and each of two nuclear service water cooling tower structures are shared by the three units. (SER, §1.2.3).

127. The steam and power conversion system for each unit will be designed to remove heat energy from the nuclear steam supply and convert it into electrical energy by means of a steam turbine generator. (SER, §10.1 and Appendix A, §5.1). Waste heat rejected to turbine condensers will be discharged from the closed-cycle circulating water system to the atmosphere through mechanical draft cooling towers. (SER, §1.2.3).

128. Perkins will have a number of engineered safety features designed for limiting the consequences of postulated accidents. The principal engineered safety features include the emergency core cooling systems, the reactor containment systems (including the containment heat removal system), the control room filtration systems, the ultimate heat sinks, the hydrogen control system, and the redundant onsite power systems.

129. A major portion of the Applicant's description of the proposed design of the facilities, including the principal architectural and engineering criteria for the design appears in the CESSAR. The Staff has testified as to the adequacy of the Applicant's description (SER, §21.0) and the Board will adopt their testimony in that respect.

Quality Assurance

130. The Applicant's Quality Assurance Program has been described in a topical report which was incorporated by reference into the PSAR and is part of the record in this hearing. This program has been reviewed by the Staff and judged adequate to satisfy the requirements of Appendix B to 10 CFR Part 50. (SER, §17.2).

Technical Qualifications

131. Duke Power Company is responsible for the design, construction, and operation of the Cherokee Nuclear Station. Duke Power Company will act as its own architect engineer and be responsible for all site construction activities. Combustion Engineering, Inc., will design the nuclear steam supply systems.

132. The Applicant's proposed organization and training programs have been reviewed by the Staff. (SER, §13.1). They questioned the Applicant's proposal to reduce the required experience of the Radiation Protection Manager from nine to seven years. This matter has been resolved to the satisfaction of the Staff. (Cherokee Tr. 948-949).

133. The Staff has concluded that the Applicant has an acceptable organization to design and construct the facility and that the proposed plant organization, their qualifications, and the plans for offsite technical support of plant operations are acceptable. (SER, §13.1). The Board relies on the Staff testimony in concluding that the Applicant is technically qualified to design and construct the Cherokee plant.

Common Defense and Security

134. The Applicant states that the activities to be conducted will be within the jurisdiction of the United States and that all of the directors and principal staff officers are citizens of the United States. The Applicant is not owned, dominated, or controlled by an alien, foreign corporation, or a foreign government. The activities to be conducted do not involve any restricted data, but the Applicant has agreed to safeguard any such data that might become involved in accordance with the requirements of 10 CFR Part 50. The Applicant will obtain fuel as it is needed from sources of supply available for civilian purposes, so that no diversion of special nuclear material from military purposes is involved. (SER, §19). The Board finds that the issuance of construction permits for the Cherokee units will not be inimical to the common defense and security.

Research and Development

135. No new research and development programs have been identified as necessary to reach a final design. There are, however, a number of test programs which Combustion Engineering, Inc., will conduct to demonstrate the safety of the CESSAR

System 80 design to the satisfaction of the Staff including: design tests of 16 x 16 fuel assembly, verification of in-reactor fuel densification, loss-of-coolant accident refill tests, blowdown heat transfer tests, verification of reflood heat transfer coefficients, verification of assumed iodine partition factors, development of a realistic and conservative model for the iodine spiking phenomenon, verification of models used to predict transient and accident loads on the steam generator, and demonstration of performance of the proposed core protection calculator system software and hardware. (SER, Appendix A §1.4). In addition, the Staff's generic evaluation of anticipated transients without scram is not yet complete. (SER, Appendix A, §15.6).

136. The Staff has evaluated those requirements needed to complete the safety analysis and concluded there is reasonable assurance that they will be resolved and the final design will be acceptable. (SER, Appendix A, §§1.4 and 19.0). The Advisory Committee on Reactor Safeguards has also concluded that the items left to be accomplished can be resolved during construction and, when resolved, will allow the Cherokee Units 1, 2, and 3 to be operated without undue risk to the health and safety of the public. (SER, Supp. 1, Appendix C). The

Board has reservations as to the adequacy of the Staff's treatment of some generic safety issues and will reserve findings until the supplemental testimony promised by the Staff has been received.

B. BOARD QUESTIONS

137. On July 7, 1977, the Board addressed several questions to the parties concerning health and safety aspects of Perkins.[18/] These questions dealt with anticipated transients without scram ("ATWS"), atmospheric diffusion, evacuation, unresolved safety questions, dilution of liquid waste, compliance with Regulatory Guide 1.4, percentage of by-pass leakage and magnitude of the Safe Shutdown Earthquake. Both the Applicant and Staff presented testimony in this regard. (See Applicant's Response, following Cherokee Tr. 940 and NRC Staff Response, following Tr. 2017 respectively). Each topic will be addressed separately below.

138. Board Questions 1, 2, 4, 6, 7, and 8 applied to both Cherokee and Perkins. Findings with respect to those questions have been reported in the Cherokee Partial Initial

---

18/ The questions were also directed to the health and safety aspects of Cherokee.

Decision of December 30, 1977 (6 NRC Nc. 6 pp. 1314-1333) and will not be repeated here. We will address Questions 3 and 5 which apply only to Perkins.

139. Question 3: Evacuation at Forest Lake Camping Resort

> "Does the possible 2100 people at the Forest Lake Camping Resort, 3 miles east of the Perkins site, pose a problem in evacuation within 2 hours in the event of an accident?"

140. The Applicant stated that there are two exits from the campground to Highway 64, a major state highway. It believes that evacuation of the people at the campground within two hours is reasonable. It noted that the finalization of Emergency Plans will be considered in detail at the operating license stage. (Applicant's Response at p. 6, following Cherokee Tr. 940).

141. The Staff stated that its review experience is that emergency plans can be developed without any unusual difficulty to include capability for evacuating 2100 people concentrated at a location 3 miles from a site. Transient populations, like those at the camping resort, are generally highly mobile and would have motor vehicles available. A

vehicle capacity from 1,000 to 4,000 cars per lane per hour has been observed in actual evacuations. Using 2,000 cars per lane per hour and assuming two persons per car, the entire camping resort could be evacuated in about one-half hour, well within the 2-hour time frame. (Staff Response, at pp. 7 and 8, following Tr. 2017; Tr. 2051-52). The Staff also provided examples of how individuals at such locations could be notified. (Tr. 2052-55).

142. The Board finds that the responses have adequately treated its question in this area.

143. Question 5: Dilution of Liquid Wastes by Pumping of By-Pass Water

> "What is now proposed at Perkins and Cherokee with regard to pumping by-pass water for the dilution of liquid wastes? We were told that such a by-pass stream was necessary in order to meet 10 CFR 20 requirements. Explain."

144. The Applicant stated that pumped dilution was not needed at Cherokee because the liquid wastes were released directly into the water flowing through the dam which would provide adequate dilution to meet Part 20 requirements. At Perkins provision is made for pumping as

much as 280 cfs of by-pass water. (ER, Table 3.3.0-1). The Applicant stated that such a by-pass stream may be needed to meet Part 20 requirements on a short-term basis when the radioactive releases are unusually high. (Applicant's Response at p. 8, following Cherokee Tr. 940).

145. In the Staff's opinion the provision of so large a dilution flow reflects the Applicant's choice to facilitate batch releases of liquid radioactive wastes rather than slower continuous releases as well as provide other operational flexibilities.

146. Although slower releases might be preferable, the Applicant will at all times comply with 10 CFR Part 20; the operating specifications will assure compliance with Appendix I for the average release rates. No member of the public will be exposed to a radiation dose as high as 5 millirem per year as a result of liquid releases from the Perkins plant.

Financial Qualifications

147. In addition to the written questions discussed above, the Board had orally advised the Staff that it wished to explore the Staff's evaluation of the Applicant's financial

qualifications. The Staff presented a witness who testified that he is satisfied that Applicant is financially qualified to design and construct the proposed Perkins and Cherokee facilities. (Perkins Tr. 2127).

148. The Commission's Regulations relating to the determination of an applicant's financial qualifications appear in Section 50.33(f) and Appendix C to 10 CFR Part 5. These Regulations state that there must be reasonable assurance that an applicant can obtain the necessary funds to cover the estimated construction costs of a proposed nuclear power plant and its related fuel cycle costs. This standard of reasonable assurance, however, must be viewed in light of the extended period of time from the start of construction to the date of commercial operation. The earliest dates for commercial operation of the Cherokee and Perkins plants are estimated to be January 1984, for Cherokee Unit No. 1; January 1985, for Perkins Unit No. 1; July 1986, for Cherokee Unit No. 2; July 1987, for Perkins Unit No. 2; January 1989, for Cherokee Unit No. 3; and January 1990, for Perkins Unit No. 3.[19/] Consequently, one must necessarily make

---

19/ The dates for commercial operation stated above were the ones used by the Staff witness in analyzing the ability of the Applicant to finance the construction of the plant. On January 9, 1978, the Applicant announced that Perkins Units 1 and 3 will each be delayed three years (to 1988 and 1993 respectively) and Perkins No. 2 will be delayed four years (to 1991). This delay should not make financing more difficult and we see no reason for re-evaluating the testimony on financial qualifications.

certain assumptions about future conditions. Two basic assumptions the Staff has made in its analysis are that there will be rational regulatory policies with respect to the setting of rates and that viable capital markets will exist. The former assumption implies that rates will be set to at least cover the cost of service, including the cost of capital; the latter assumption implies that capital will be available at some price. Given these assumptions, the Staff then focused on the reasonableness of the Applicant's financia planning.

149. The Staff witness further testified as to the reasonableness of the Applicant's financial assumptions. (Perkins Tr. 2129, 2218). He stated that the policy to internally generate 40% of capital requirements projected by Applicant is reasonable and attainable (Perkins Tr. 2224; SER Supp. §20.4) and that Applicant's assumptions of 51% long-term debt, 13% preferred stock, and 36% common stock is in line with other utilities. (Perkins Tr. 2147; SER Supp. §20.3.2, 20.4).

150. The Board inquired as to Applicant's experience with interest coverage. (Perkins Tr. 2148-54). The Staff testified that the past experience of the Company is that they have been able to maintain a reasonable interest

coverage figure. (Perkins Tr. 2156). Further, it also testified that the Company has been in an improving position over the past two years with respect to interest coverage. (Perkins Tr. 2156). In response to a specific question, the Staff stated that the increase in the Applicant's construction project due to Cherokee should not worsen the Company financially, for as long-term debt increases, items that make up the coverage of interest would also be increasing. (Perkins Tr. 2157).

151. The Staff evaluated Duke's plant growth rates to determine if the Applicant was attempting to undertake a program beyond that which it achieved in the past ten years and found that the proposed construction program was not beyond what they had achieved in the past. (Perkins Tr. 2180). Applicant's annual compound growth rate was 15% in terms of gross plant for the period 1966-1976; for the period 1976-1986 it will be 11½%. (Perkins Tr. 2179, 2202). In the event growth does not meet projections of the Applicant, the Staff stated such would not have a serious effect on the financial condition of the Company inasmuch as the Company has several alternatives available, such as slowing construction and selling power outside. (Perkins Tr. 2162, 2185-89; See Also Tr. 2146).

152. The Staff stated that it had received all the information it needed from the Applicant to make a determination as to financial qualifications (Perkins Tr. 2166) and that it will continue to keep abreast of the current financial situation of the Applicant. (Perkins Tr. 2165).

153. The Staff has reviewed the financial information presented in the application, and amendments thereto, and has concluded that there is reasonable assurance that the Applicant can raise the necessary funds to design and construct the Cherokee facility. Accordingly, the Staff found Applicant financially qualified to carry out the activities for which the construction permits are sought. This conclusion was based on detailed analyses and the Staff's determination that the Applicant's projected financing plans and underlying assumptions are reasonable. The conclusion was also based on the assumption of rational regulatory policies and viable capital markets. These assumptions were necessary because of the lengthy future period involved and the expected heavy dependence on external financing. The Board finds that the Staff's review was adequate.

IV. CONCLUSIONS OF LAW

154. The Board has reviewed the entire record of this proceeding, including the proposed findings of fact and conclusions of law submitted by the parties. All of the proposed findings and conclusions submitted which are not incorporated directly or inferentially in this Partial Initial Decision are herewith rejected as being unnecessary to the rendering of this Partial Initial Decision.

155. The Board concludes that the review of the application by the Staff has been adequate except for consideration of generic safety issues and alternate sites. The Board's Order of July 14, 1978, determined that the record would be reopened to receive additional evidence on alternate sites. We will also expect supplementary testimony from the Staff concerning the plans for dealing with certain generic safety issues.

156. Findings in accord with 10 CFR 50.35(a) and findings concerning the health and safety of the public will be reserved pending the receipt of additional evidence concerning generic safety issues. At this time we find that:

(1) The Applicant is technically qualified to design and construct the proposed facilities.

(2) The Applicant has reasonably estimated the costs and is financially justified to design and construct the proposed facilities.

(3) The issuance of permits for construction of the facilities will not be inimical to the common defense and security.

157. The Board's conclusions under the National Environmental Policy Act of 1969 (NEPA) and the requirements of 10 CFR Part 51 will be deferred pending the completion of the evidentiary hearing on alternate sites.

V. ORDER

Based upon the Board's findings and conclusions, and pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's Regulations, IT IS ORDERED, in accordance with 10 CFR §2.760, §2.762, §2.764, §2.785, and §2.786 that this Partial Initial Decision shall become effective immediately and shall constitute with respect to the matters covered therein the final action of the Commission forty-five (45) days after the date of issuance hereof, sub-

ject to any review pursuant to the Commission's Rules of Practice. Exceptions to this Partial Initial Decision may be filed by any party within ten (10) days after service of this Partial Initial Decision. Within thirty (30) days thereafter forty [(40) days in the case of the Staff] any party filing such exceptions shall file a brief in support thereof. Within thirty (30) days of the filing of the brief of the appellant [forty (40) days in the case of the Staff], any other party may file a brief in support of, or in opposition to, the exceptions.

FOR THE ATOMIC SAFETY AND
LICENSING BOARD

Donald P. deSylva

Donald P. deSylva, Member

Walter H. Jordan

Walter H. Jordan, Member

Elizabeth S. Bowers

Elizabeth S. Bowers, Chairman

Dated at Bethesda, Maryland
This 27th day of October 1978.