

NRC PUBLIC DOCUMENT ROOM

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD



In the Matter of

DUKE POWER COMPANY

(William B. McGuire Nuclear
Station, Units 1 and 2)

11/2/78
Docket Nos. 50-369
50-370

G

NRC STAFF'S PROPOSED FINDINGS OF FACT
AND CONCLUSIONS OF LAW IN THE FORM OF
A PARTIAL INITIAL DECISION

November 2, 1978

Edward G. Ketchen
Counsel for NRC Staff

Richard K. Hoefling
Counsel for NRC Staff

7811210100-6,6

TABLE OF CONTENTS

	<u>Page</u>
I. Introduction.....	
II. Seismology.....	
III. Financial Qualifications.....	
IV. Uranium Fuel Cycle -- Health Effects and Radon-222.....	
V. Conclusions of Law and Decisional Conditions.....	
VI. Order.....	
Decisional Record (Appendix A).....	

(5) financial qualifications; and (6) solar power. The Stipulation was approved by the Licensing Board in its Memorandum and Order of December 24, 1975.

3. Evidentiary hearings on the environmental contentions, i.e., contentions 1, 2, and 6 were held in Charlotte, North Carolina, on March 28-31, 1977, April 1, 1977, and April 19-22, 1977. Proposed findings of fact and conclusions of law on the environmental issues were filed by the Applicant on July 19, 1977; the Intervenor on July 25, 1977; and the NRC Staff on August 26, 1977. The Applicant filed a reply to Intervenor's findings on August 5, 1977.
4. Evidentiary hearings on the health and safety contentions, i.e., seismology and financial qualifications, and on the Radon-222 matter were held in Charlotte, North Carolina on August 22-24, 30-31, 1978. Proposed findings of fact and conclusions of law were filed by the Applicant on October 6, 1978, the Intervenor on October 19, 1978, and the NRC Staff on November 2, 1978.
5. At the operating license stage of review, the Licensing Board is guided by the requirements of 10 CFR Part 2, Appendix A, VIII.

II.
Seismology

Contention 3

Operation of the McGuire plant will threaten health and safety of CESG members in that the plant's design is inadequate to assure protection against earthquakes of such intensity as can be expected to affect the site as indicated by the anomalous changes in land elevation and ground water behavior in eastern North Carolina. This indicates a much greater probability of a major earthquake of much greater intensity in that area of eastern North Carolina which would result in a much greater acceleration at the McGuire site than was considered during the construction permit proceeding.

6. The geological and seismological aspects of the McGuire nuclear site as presented in the Preliminary Safety Evaluation Report were reviewed by the NRC Staff and its advisors, the U.S. Geological Survey and the Seismological Investigations Group of the National Oceanographic and Atmospheric Administration, now a part of the U.S. Geological Survey, at the construction permit phase of this proceeding.^{1/} As a result of that review, earthquake design bases of 0.15 g and 0.08 g for the Safe Shutdown Earthquake and the Operating Basis Earthquake, respectively, were determined to be adequately conservative.^{2/}

^{1/} Safety Evaluation Report related to operation of McGuire Nuclear Station, Units 1 and 2, NUREG-0422, March 19, 1978 (McGuire SER), p. 2-21, admitted into evidence as NRC Staff Exhibit B at Tr. 1975; "Supplemental Testimony of R. McMullen and T. Bennett on Carolina Environmental Study Group Contention No. 3" (McMullen and Bennett Testimony), pp. 1-2, admitted into evidence at Tr. 2035

^{2/} McGuire SER, pp. 2-21 to 2-22; McMullen and Bennett Testimony, p. 2.

7. The NRC Staff has also reviewed the geology and seismology portions of the Final Safety Analysis Report for the McGuire station. As a result of that review, the Staff found no reason to alter its conclusions made during the Construction Permit review.^{1/}

8. Carolina Environmental Study Group (CESG) questions the conservatism of the accelerations established as the earthquake design bases for the McGuire site. CESG alleges that anomalous changes in land elevation and ground water behavior in eastern North Carolina indicate the likelihood of a major earthquake in that area of such intensity to produce accelerations at the McGuire site in excess of those established as the earthquake design bases.^{2/}

9. The anomalous conditions alleged in CESG Contention 3 have been reported to exist in eastern North Carolina in the vicinity of Wilmington and Southport, North Carolina.^{3/} The NRC Staff was informed of these conditions on January 29, 1975 when the Nuclear Regulatory Commission received a request for the issuance of an Order requiring that Carolina Power and Light Company show cause why its license to operate the Brunswick Steam Electric Plant should not be amended to require a

^{1/} McGuire SER, p. 2-22; McMullen and Bennett Testimony, p. 2.

^{2/} CESG Contention 3, supra, p. 5.

^{3/} Staff Report ("Staff Report"), p. 1, attached to a December 14, 1977 Memorandum to A. Schwencer from J. C. Stepp entitled, "Brunswick Seismic Network," (attached to the McMullen and Bennett Testimony).

re-evaluation of the seismic safety of the plant site. The request was based on a report by Stewart, Dunn and Heron which identified the Wilmington-Southport area of North Carolina as an area where data suggested a possibility of dilatant^{1/} phenomenon which could be followed by a major earthquake.^{2/}

10. In response to the request to re-evaluate the seismic safety of the Brunswick Steam Electric Plant site, the NRC Staff reviewed the available data and concluded that data did not exist to demonstrate whether or not dilatancy precursory to a large earthquake was occurring in the Wilmington-Southport area.^{3/} In an effort to confirm the presence or absence of dilatancy precursory to a large earthquake in the Wilmington-Southport area, the Carolina Power and Light Company, was required by the NRC Staff to undertake a program calling for (1) the establishment of a multi-station seismic network to monitor local earthquake activity and detect any seismic velocity changes which might be occurring in the area, and (2) the installation of a tide-gauging station at Southport to identify ongoing changes in elevation and to clarify the meaning of data gathered from tide gauges which existed in this area in the past.^{4/}

^{1/} Dilatancy is the increase in volume of rock corresponding to the initiation and growth of many small cracks just prior to fracture as stress is applied to the medium. Staff Report, p. 1

^{2/} Staff Report, pp. 1-2.

^{3/} Staff Report, p. 3.

^{4/} Staff Report, pp. 5-6.

11. Seven permanent station locations were selected for the seismic network which were located in an area of approximately 800 km² encompassing Wilmington and Southport, North Carolina. Each station consisted of a vertical seismometer for which the signal was transmitted over telephone lines to a central facility where the signals were permanently recorded on film. The detection capability of the network was near magnitude zero for events within the network and less than magnitude 2 for events 500 km away, achievable during periods of average background noise. In addition, personnel operating the network were intensively trained in event recognition, event timing, location and magnitude estimations, identification of seismic wave types and equipment maintenance.^{1/}
12. During the operation of this seismic monitoring network, a principal finding was that no local earthquakes have been detected in the Wilmington-Southport area.^{2/} In addition, the monitoring network determined the apparent P-wave velocity for a shallow refracting layer in the crust beneath the Wilmington-Southport area to be 6.2 km/sec. This P-wave velocity is consistent with that observed during a regional refraction survey made somewhat to the north in 1965. At that time, the velocity was found to be 6.0 km/sec or only about 3% different (which is within the measurement error). Such constancy of the P-wave velocity would not support the existence of velocity changes hypothesized as earthquake precursors.^{3/}

10/ Staff Report, p. 8

11/ Staff Report, p. 9.

12/ Staff Report, pp. 9-10.

13. In addition, the seismic monitoring network established an apparent S-wave velocity of 3.6 km/sec. The ratio of the apparent P-wave velocity to the apparent S-wave velocity is 1.72 based on data gathered by the network. This value is close to the ratio typically found in rock for seismic areas of the United States, namely 1.73.^{1/} The ratio thus measured for the Wilmington-Southport area of North Carolina does not appear to be anomalous as might be expected for a dilatant zone.^{2/}

14. In addition, the seismic monitoring network recorded several small earthquakes occurring at regional distances beyond the area of the network. For the magnitude 4.3 Summerville, South Carolina earthquake of March 1977, P-wave and S-wave velocities were determined for a deep refracting layer. The ratio of the apparent P-wave velocity to the S-wave velocity for this refraction arrival is 1.73. This value is nearly the same as the value determined for the shallow refracting layer, 1.72, and is not indicative of any anomalous behavior.^{3/}

15. None of the observations reported by the seismic monitoring network indicated that dilatancy or other earthquake precursory phenomena have been occurring in the Wilmington-Southport area. On the contrary, the complete absence of even small earthquakes from the area and the apparent constancy of seismic velocity over the region suggest that dilatancy is

1/ Staff Report, p. 10.

2/ Staff Report, p. 10.

3/ Staff Report, pp. 10-11.

not occurring or is progressing at a very slow rate. Such data do not indicate an unusual earthquake risk in the region.^{1/} Based on these results, the Nuclear Regulatory Commission permitted Carolina Power and Light Company to discontinue operation of the seismic network. It should be noted that the tide-gauge monitoring portion of the original program recommended by the NRC Staff has yet to produce results. Delays were encountered in installing the permanent tide-gauge at Southport due, in part, to problems in obtaining the necessary permits for installation.^{2/} This tide-gauge has been installed and data acquisition is taking place. At the end of two years of monitoring, the NRC Staff will review the data for any evidence of dilatancy.

16. While CESG alleged that anomalous changes in ground water behavior and land elevation in the Southport-Wilmington area indicated earthquake potential, CESG presented no evidence on this point. With regard to the alleged ground water anomalies, specifically high salinity, higher than normal temperature gradients, and high fluid pressure,^{3/} such ground water anomalies have numerous other possible explanations with no tectonic implications.^{4/} Furthermore, in responding to Board questions, Staff witness McMullen testified that the data did not support the

1/ Staff Report, p. 13.

2/ Staff Report, p. 12.

3/ Staff Report, p. 1.

4/ Staff Report, p. 2.

presence of a temperature gradient anomaly and that the increase in salinity as one progressed coastward was not indicative of anomalous behavior.^{1/} With regard to anomalous elevation changes, these changes presently remain unexplained.^{2/} However, regional uplift offers no obvious implications with regard to earthquake prediction in view of the absence of even minor earthquake activity in the Wilmington-Southport areas.^{3/}

17. In view of the complete absence of even small earthquakes from the Southport-Wilmington area and the apparent constancy of seismic velocity over the region as established by the seismic monitoring network operated by the Carolina Power and Light Company, the Board finds that dilatant activity precursory to an earthquake has not been established in that area. While the anomalous changes in land elevation remain unexplained, there is no evidence to suggest that such elevation changes indicate an increased earthquake potential in the Southport-Wilmington area. With regard to the anomalous changes in ground water behavior in eastern North Carolina, such anomalies have numerous explanations with no tectonic implications.

18. The McGuire nuclear site is approximately 200 miles from the area of the postulated anomalies, and, even in the unlikely event that

1/ Tr. 2088-2089.

2/ Staff Report, p. 13.

3/ Staff Report, p. 2.

a large earthquake occurred in the vicinity of these anomalies, the ground motion at the McGuire site would be greatly reduced due to attenuation. A major earthquake assumed to occur 200 miles from the McGuire site would not be expected to produce acceleration levels as great as those for which the facility is designed.^{1/} The earthquake design bases at the McGuire site is 0.15 g for the Safe Shutdown Earthquake.^{2/} If one postulated the occurrence of an earthquake the size of the 1886 Charleston earthquake in the Southport-Wilmington region, the Staff testified that acceleration values at the McGuire site would be between .05 g and .08 g.^{3/} This is well below the design basis for the Safe Shutdown Earthquake.

10. The Applicant also presented testimony on CESH contention 3.^{4/} Applicant concluded that for an earthquake of intensity IX, on the Modified-Mercalli (MM) intensity scale, occurring in the Southport-Wilmington region, the calculated maximum rock acceleration at the McGuire site would be 0.0125 g.^{5/} The Applicant's value of 0.0125 g differs from the Staff's value

^{1/} McGuire SER, p. 2-23; Bennett and McMullen Testimony, p. 4.

^{2/} Bennett and McMullen Testimony, p. 2

^{3/} Bennett cross-examination, Tr. 2056-2057.

^{4/} "Testimony of S. B. Hager" (Hager Testimony) follows Tr. 2025. Although this testimony was originally sponsored solely by Mr. Hager, it was later adopted and co-sponsored by Clay E. Sams (Tr. 1956) and by George F. Sowers (Tr. 1984).

^{5/} Hager Testimony, p. 3.

of 0.05 - 0.08 g. However, to reach its values, the NRC Staff employed an intensity X for the 1886 Charleston earthquake, which would have produced an acceleration of 0.05 g using the Applicant's method.^{1/}

Furthermore, the methodology employed by the NRC Staff was more conservative than that used by the Applicant, producing a more conservative value in the range 0.05 - 0.08 g.^{2/}

20. The Board finds that even were a major earthquake presumed to occur in the vicinity of Southport-Wilmington, North Carolina, the McGuire site is sufficiently distant from this area that the ground motion at the McGuire site would be greatly reduced due to attenuation and such a postulated earthquake would not produce acceleration levels as great as those for which the McGuire facility is designed.

1/ Cross-examination of Sams, Tr. 1968-69.

2/ Cross-examination of Bennett, Tr. 2056-57.

III.
Financial Qualifications

Contention 5

The Applicant is not financially qualified to operate and decommission the McGuire plant in that, among other things: Rate increases are not likely to be granted because they will be required by the Applicant's financial and business practices, which, in general, violate North Carolina state requirements to provide electricity at the lowest price possible, as exemplified by, among other things, the following violations of specific state requirements:

(a) That a utility not overbuild generating capacity. Applicant, on the contrary, has a massive expansion program unsupported by evidence that future demand will require it; and

(b) A utility is not to be overcharged by a wholly-owned subsidiary, which the Applicant has violated by purchasing over-priced coal from its coal mining operations.

The North Carolina Utilities Commission is not likely to permit the McGuire Plant, and several of Applicant's plants scheduled for completion after McGuire, into the Applicant's rate base, because to do so would violate State requirements prohibiting unneeded or prematurely constructed facilities as part of the rate base; and

In the event that the North Carolina Utilities Commission grants the Applicant rate increases and/or includes McGuire and other plants in the rate base regardless of the factors outlined above, the rates required by the Applicant will be so high (due to the financial and business practices outlined above, among other things) that demand and sales will be so severely affected that not even additional rate increases will be adequate to maintain the Applicant's solvency.

21. The Applicant, the Staff, and Carolina each offered testimony on the financial qualifications contention. The Board has considered the entire record, which includes the evidence presented by the parties at the hearings held on August 22-24, 30-31, 1978, and evaluated the financial qualifications of the Applicant in these proceedings from the perspective

of the agreed issue, and from the perspective of the Commission's requirements for financial qualifications at the operating stage of review of a request for a license to operate a nuclear power plant. The Board's evaluation of the financial qualifications of the Applicant considers the financial qualifications issues raised by the contention in conjunction with the overall issue of whether the Applicant meets the criteria of the Commission's regulations with respect to financial qualifications, i.e., 10 CFR §50.33(f) and 10 CFR Part 50, Appendix C. Thus,

If the application is for an operating license, such information shall show that the Applicant possesses or has reasonable assurance of obtaining the funds necessary to cover the estimated costs of operation for the period of the license or for five years, whichever is greater, plus the estimated costs of permanently shutting the facility down and maintaining it in a safe condition....

10 C.F.R. §50.33(f).

22. For an established organization, Commission regulations provide that fulfilling the financial qualifications requirement may be accomplished by showing at the time of filing of the application that the Applicant has available resources sufficient to cover estimated operating costs for each of the first five years of operation plus the estimated costs of permanent shutdown and maintenance of the facility in safe condition.^{1/} In most cases, an Applicant's annual financial statement contained in its published annual reports are sufficient to enable the Commission to evaluate the Applicant's financial capability to satisfy the financial qualifications requirement.^{1/}

^{1/} 10 CFR 50, Appendix C, §I, B.

23. Our findings are necessarily based on the premise that the Board is evaluating the Applicant's financial qualifications pursuant to Commission's criteria at the operating license stage as distinguished from the construction permit stage. Our criteria for weighing the evidence is also necessarily based on the Commission determination that local stage agencies or the Federal Energy Regulatory Commission (FERC), not the Nuclear Regulatory Commission, are the primary source of evaluation of rates necessary for a utility to operate in an efficient manner and receive an adequate return on investment.^{1/}

24. In the Seabrook case, although it involved a construction permit application the Commission stated:

The regulations are amplified by Appendix C to 10 CFR Part 50, which sets forth guidance on the financial data required of license applicants. The appendix makes clear that the "reasonable assurance" concept embodied in the regulation is more flexible than many of the Commission's safety criteria. It states that:
The kind and depth of information described in this guide is not intended to be a rigid and absolute requirement....

* * * *

^{1/} Public Service Company of New Hampshire, et al. (Seabrook Station, Units 1 and 2), CLI-78-1, 7 NRC 1 (1978).

In determining an applicant's financial qualifications, the Commission will require the minimum amount of information necessary for that purpose. No special forms are prescribed for submitting the information. In many cases, the financial information usually contained in current annual financial reports, including summary data of prior years, will be sufficient for the Commission's needs. [Seabrook, supra, at 9.]

* * * * *

The history of adoption of Appendix C also indicates that the "reasonable assurance" requirement is not rigid and that it does not normally contemplate refined analysis of an Applicant's likely future ability to meet specific costs. [Seabrook, supra, at 10.]

* * * * *

This history suggests that for established utilities with substantial operating records, close scrutiny of financial qualifications was not viewed as necessary to assure that financial considerations did not compromise safety. [Seabrook, supra, at 11.]

25. The large financial investment required to build nuclear power plants is a practical consideration that is reflected in the regulations. At the construction permit stage the strain on a utility of the huge capital intensive outlays need a more careful look than at the operating license stage when the facility is completed. At the operating license stage the issue is whether the Applicant is able to obtain the requisite funds to operate a completed plant. That burden is eased considerably by the fact that an operating facility will pay its own way by the electricity it sells. Obviously, this is not the case when construction authorization is considered where there are enormous capital outlays without offsetting income.

26. Further financing related to the McGuire Nuclear station is virtually unnecessary once the McGuire nuclear facility becomes a part of the electrical rate base. ^{1/}
27. Duke Power Company recovers its operating and maintenance costs including depreciation and capital costs through rates charged electric customers. The Company's rates are set by regulatory agencies of both North Carolina and South Carolina and the federal government. Both States allow a fair rate of return on the company's investment. ^{2/} Thus, the rates will be set by North Carolina Utilities Commission (NCUC) for North Carolina. The Public Service Commission of South Carolina (PSC) for South Carolina and the Federal Energy Regulatory Commission (FERC) for the Company's interstate wholesale operations. These agencies have concurred with the Duke Power Company's plans to build and operate a system of baseload nuclear generating facilities. ^{3/}

^{1/} Testimony of Richard C. Ranson ("Ranson"), Treasurer, Duke Power Company, Atomic Safety and Licensing Board, Operating license McGuire Nuclear Station, Testimony filed July 28, 1978 for hearing commencing August 22, 1979, following Tr. 2510, p. 3.

^{2/} Ranson, p. 3.

^{3/} Ibid.

28. Rates set by the Commissions do not always produce the needed revenues. Over short periods of time, allowed rates may produce either insufficient or overly great revenues because of the lag between the time when rates are set by the respective state or Federal rate-making agencies based on historical data and the needed revenues. The short-fall or the overage can be measured by the difference between that return on common equity allowed and that achieved. This assumes that the allowed return on common equity is no less than the actual cost of common equity. Both the NCUC and the PSC allowed Duke Power Company a 13-¹/₂% return on common equity as a fair return in late 1975 and early 1976. Duke Power Company achieved earnings of 12.7% in 1976, 12.2% in 1977, and 11.7% for the twelve months ended June 30, 1978.^{1/}
29. There is no evidence on this record that Duke Power Company will not receive favorable treatment with respect to fair and reasonable rate relief before the respective state or Federal rate setting agencies. In 1977 the NCUC found that nuclear power was a preferred means for baseload generation. The appropriate regulatory agencies in both North Carolina and the State of South Carolina have continued to issue certificates of convenience and necessity for the design and construction of additional nuclear generating plants by Duke Power Company.^{2/}

^{1/} Ranson, p. 4.

^{2/} Ranson, p. 5.

30. Duke Power Company's rates have historically been among the lowest in the nation. They remain approximately 25% below the rates charged by the average investor-owned utility and 15% below those charged on the average by all electric utilities. This will cause Duke to continue to be an attractive financial investment. Duke Power Company has a generally good financial strength and is following a program designed to even further improve its financial position.^{1/}

31. Duke's credit position has improved significantly since 1974 as evidenced by the upgrading of the classification of its securities and first mortgage bonds.^{2/} The improved ratings improve Duke Power Company's financial strength by allowing greater flexibility, lower financing costs, and ultimately relatively lower rates by reducing financing costs.^{3/} Duke's liquidity position has improved due to the fact that it has increased its available lines of credit to \$280 million.^{4/} It's policy is generally to maintain short-term debt levels below \$175 million. During each of the last three years, Duke Power Company has eliminated all of its short-term debt at least once.^{5/}

^{1/} Ranson, p.6.

^{2/} Ibid.

^{3/} Ibid.

^{4/} Ibid.

^{5/} Ranson p. 6-7.

32. Financial data for Duke Power Company for the five years ending 1977 shows that Duke Power Company's revenues have increased from 1973 to 1977, and that the earnings per share have increased in 1977 over those in 1973. There was a dip in both 1974 and 1975 in earnings per share.^{1/} However, this can be attributed to an economic recession.^{2/} Since 1973, except for 1974 and 1975, Duke's return on common equity has increased as has the pre-tax interest coverage.^{3/}

33. The source of funds to cover Applicant's operating costs for the McGuire facility, including those relating to decommissioning, will be through revenues generated from its system-wide sales of electricity. At the end of 1977, the unit price from system-wide sales of electric power was 25.94 mills per kilowatt hour.^{4/} This price is comparable to the projected operating costs of 25.91 mills per kilowatt hour and does not reflect possible rate increases during the first five years of commercial operation.^{5/} Historically, Duke Power Company has consistently demonstrated the ability to achieve revenues sufficient to cover all operating costs and interest charges.^{6/}

1/ Staff Exh. C, (SER, Supp. 1, NUREG-0422), p. 20-2.

2/ "Supplemental Testimony of Louis Gittleman on Financial Qualifications" ("Gittleman"), following Tr. 2096, p. 3.

3/ Staff Exh. C, (SER, Supp. 1, NUREG-0422), p. 20-2.

4/ Staff Exh. C, pp. 20-18, 20-2; Tr. 2111, 2116.

5/ Staff Exh. C, p. 20-2; See, Tr. 2155-56.

34. Over \$300 million in additional revenues have been granted by the regulatory authorities regulating Duke over the past five years. Total revenues have risen seven-hundred million dollars since 1973.^{1/} The difference in total revenues and the additional rate increases granted by the regulatory authorities over the past five years is attributable to increased customers, increased usage per customer, and the fuel adjustment clause. The regulatory jurisdictions to which Duke Power Company is subject allow adjustments in rates for fluctuations in fuel expense.^{2/}
35. Electric revenues for 1977 increased 14% reflecting a 7% increase in Kwh sales in the collection of higher revenues through fuel cost adjustment procedures. Electric revenues for 1976 increased 19% reflecting the full impact of rate increases implemented in mid-1975 and 8% increase in Kwh sales, and the continuation of revenue collections under fuel cost adjustment procedures. These increases in Kwh sales followed three years of relatively flat sales growth due at least in part to an economic recession and occurred despite a steady rising price per Kwh.^{3/}

^{1/} Gittleman, p. 2.

^{2/} Ibid., p. 2-3.

^{3/} Id., p.3.

In future years, most likely the regulatory bodies which set Duke's rates will grant rate increases to offset legitimately rising operating expenses. There is no basis for a conclusion that additional rate increases to offset legitimate operating expenses will impede demand or sales to affect applicant's financial qualifications.^{1/} Although rising electric rates may encourage conservation efforts and impede demand growth, this does not necessarily lead a conclusion that rising rates will lead to Duke Power Company's bankruptcy.^{2/}

36. It appears likely that rate increases will be granted in future years to offset legitimately rising operating expenses. This seems especially true in view of the fact that the NRC Staff is unaware of any case where Duke Power Company has been found guilty of violating any state requirements^{3/}. Furthermore, since sales growth has rebounded in recent years in the face of rising rates, the Staff maintained that there seems to be little basis for contending that additional rate increases will so severely affect demand and sales that not even additional rate increases will be adequate to maintain the Applicant's solvency. It may very well be that rising rates will encourage conservation efforts and thus slow demand growth, but that is quite different from contending that rising rates will lead to bankruptcy.^{4/}

^{1/} Gittleman, p. 3.

^{2/} Ibid., p. 4.

^{3/} Id., p. 3.

^{4/} Id., p. 3-4.

37. Finally, Applicant addressed the matter of the impact of decreasing sales and adverse rate treatment on the financial ability to operate McGuire. If sales fall below the anticipated level, there will be lower earnings and several options would be available to Applicant. One would be to apply to the appropriate regulatory agencies for a rate increase; another option could be deferral of construction; or lastly, the company could ride things out for a period of time.^{1/}
38. Applicant stated that if favorable rate relief was not received, it would reduce its construction program. However, Applicant would complete McGuire. It would not be practical either to the Company's customers or its stockholders to cancel McGuire because it is so near completion.^{2/}
39. We find that Duke will continue to achieve revenues sufficient to cover all operating costs and interest charges related to the operation of the McGuire facility.
40. With respect to the allegation of unfavorable rate treatment due to violation of North Carolina law, Intervenor stated that it was unaware of any court of competent jurisdiction in North Carolina or any agency or other regulatory body that has found Applicant's financial and business

^{1/} Tr. 2578-79

^{2/} Tr. 2584-85.

practices to be in violation of North Carolina requirements as to the provision of electricity.^{1/} There is no evidence in this record to support the allegation that Applicant has violated any North Carolina statute or other requirement with respect to its financial or business practices. Rather, the evidence shows that there has been no such violation.^{2/}

41. Intervenors argued that The Public Service Commission of South Carolina was investigating Applicant's practices with respect to coal purchases.^{3/} There is no basis in the record for concluding that Duke has been improperly charged for coal purchases by a subsidiary.^{4/} PSC's recent Order on the subject of Duke's coal purchases was the culmination of a proceeding which served as the basis for Intervenor's allegation of violation of state law. PSC recently found Applicant's coal purchase practices from its subsidiaries not to be "unreasonable or detrimental to the public interest".^{5/}

1/ Tr. 2251

2/ Gittleman, p. 3; Ranson, p. 4-5; Tr. 2541.

3/ Tr. 2255-56.

4/ Tr. 2541; Ranson, pp. 8-10.

5/ Tr. 2543-44.

42. Applicant will need the power from the McGuire facility to provide the electrical power required by its customers.^{1/} Accordingly, the Applicant has not overbuilt generating capacity in violation of any North Carolina state requirement that is within this Board's jurisdiction to consider.
43. The Board has given little weight to the material set forth at pages 1-4 of Intervenor's testimony.^{2/} It is highly speculative and irrelevant.
44. We perceive Intervenor's key point is that due to increasing costs of electricity to the consumer, particularly the residential consumer, the demand for electricity on the Duke system will level off at a peak load requirement during any particular year of about 9500 MWe. According to CESG, Duke will be unable to obtain the necessary rate increases to cover ever increasing costs. These costs, it is said, will continue

^{1/} NRC Staff's Proposed Findings of Fact and Conclusions of Law in the form of a Partial Initial Decision, August 26, 1977, p. 8, pp. 8-29.

^{2/} "Testimony of Jesse Riley," ("Riley"), August 14, 1978, following Tr. 2238.

to increase without offsetting rate increases due to depressed demand. As demand and sales level off, Duke will be forced to request still further rate increases which will further increase the price of electricity to the individual user. This will result in still further reduction in sales. This spiral downward, according to CESG, will continue until Duke becomes insolvent.^{1/}

45. According to CESG, the residential customer will cut back on electrical use -- thus driving the price of electricity higher -- either by the institution of conservation practices as a reaction to the ever-increasing costs, or by changes to alternative energy sources.^{2/} CESG has not demonstrated, however, by any evidence before us that Duke does not have the funds, or that it does not have reasonable assurance of obtaining the funds necessary, to operate McGuire, even if demand for power on the Duke system levels off at between 9000 - 10,000 MWe^{3/}.

46. CESG's testimony provides no factual basis that demonstrates that the appropriate rate-making bodies will not grant favorable rate increases to Duke sufficient for it to cover its operating costs and

^{1/} Riley, pp. 4-7, 12.

^{2/} Riley, p. 4-6.

^{3/} Riley, p. 5.

make a reasonable profit. CESG's evidence shows that it estimates Duke's interest rate on imbedded debt and preferred stock in excess of 8% and common equity earnings in vicinity of 12% to 15%.^{1/} Similar figures were used by both the Staff and the Applicant in evaluating Duke's financial qualifications.^{2/} CESG argues that the interest rate on embedded debt and preferred stock in excess of 8%, and common equity earnings in the vicinity of 12-15% will work a burden on Applicant's residential customers. CESG further argues that because of an unsupportable burden of fixed charges in direct and indirect electricity costs, Duke's customers will switch to alternative energy sources reducing the use of electricity to an absolute minimum.^{3/} CESG claims that then "the sales base, smaller than present, will be swamped by the fixed charges; the rates will discourage all [but] the most unavoidable uses of electricity by most of Applicant's customers."^{4/} We have examined this in the face of past rate increases and charges. In our view, the evidence does not indicate that the sales on Duke system will decrease in the face of the fixed charge component from construction.

47. There is no basis shown in the Riley testimony that the granting of rate increases requested by the Applicant will result in reduced use of electricity by customers. Duke will obtain the necessary revenues, near

^{1/} Riley, p. 6.

^{2/} Staff Exh. C, p. 20-2, See, Tr. 2128-29; Tr. 2145-47; Ranson, pp. 4, 9.

^{3/} Riley, p. 6-7.

^{4/} Ibid.

its allowed rate of return on equity, required to operate effectively and efficiently, and to receive a reasonable profit.^{1/}

48. CESG's testimony, in part, outlines Duke Power Company's ranking when compared to other investor owned utilities.^{2/}

49. CESG concludes that despite a very high rank in profit, Duke showed a very low total return to investor.^{3/} It says that too much of Duke's earnings is plowed back into the capital intensive business and that this means that Duke will not appeal to investors.^{4/} Mr. Riley reasons that the difference between the medium profit shown and the equity, i.e., the money turned back into the capital construction program, constitutes a high cost to the consumer and does not provide the investor with a competitive return. From this, CESG concludes that there is no consumer benefit in very capital intensive generating systems.^{5/}

^{1/} Gittleman, pp. 3-4; Ranson, pp. 4-6, 10.

^{2/} Riley, p. 8.

^{3/} Riley, p. 8.

^{4/} Riley, p. 8.

^{5/} Ibid.

50. We have examined Mr. Riley's testimony with respect to saturation.^{1/} ^{2/}
The essence of CESG's point is that eventually the electricity use by Duke's residential customers will saturate. Duke Power Company's demand will then level off. Even if this should happen, and we believe this to be highly unlikely, Duke is capable of making appropriate adjustments in its building program and for that matter in its method of operation and in its rate request position before the appropriate rate-making bodies.^{3/}
51. CESG's testimony with respect to alternatives is simply rehash of earlier testimony that it gave in these proceedings on the need for power issue. Mr. Riley's testimony at the bottom of page 10 and the top of page 11 was of little value in helping us reach our determination of financial qualifications.^{4/}

^{1/} Saturation in the use of electricity is the concept that consumers will reach an upper level of consumption for appliances which use electricity. Thus, when all the individual consumers have as many television sets as they are most likely to buy, this will be reflected in a leveling of demand for electricity. When every person in the Duke service area that wants one has a television set, "saturation" indicates that electrical demand, to the extent affected by the demand and use of television sets, will level off. Increases after that point, according to the theory, would occur at a rate relative to the increase in population. See Testimony, pp. 23-24. Tr. 1192-1198. NRC Staff's Proposed Findings of Fact and Conclusions of Law in the Form of a Partial Initial Decision, (August 26, 1977) p. 25, n. 3. "Saturation" in per capita demand for electricity will not affect the requirement for operation of the McGuire units in 1979-1980. Moreover, even if the demand on the Duke system decreased because of increasing saturation in demand by residential consumers, the McGuire facility should be operated because of significant production cost savings. NRC Staff Proposed Finding 32, p. 27 (August 26, 1977).

^{2/} Riley, pp. 8-9.

^{3/} Supra, p. 22

^{4/} Riley, pp. 10-11.

52. The Riley testimony on the political nature of regulatory bodies does not advance CESG's cause on the financial qualification issue in this proceeding.^{1/} The Riley testimony, in large part, does not address many of the allegations in the specifications. In any event, we find that the Intervenor has failed to prove either the conclusion of the stipulated contention or any of the sub-bases in support of its position on the question. Intervenor simply has not shown that the Applicant does not have funds or reasonable assurance of obtaining them in order to operate the McGuire facility.
53. On the other hand, Applicant has been quite successful in the recent past in improving its financial position in the commercial market for a long-term debt financing.^{2/}
54. Duke Power Company has considered accounting methods for paying the estimated costs of permanently shutting down a facility (decommissioning) and maintaining it in a safe condition. There are various methods which Duke Power Company may apply once the estimated costs of permanently shutting down the facility are specified. Both NCUC and the Federal Energy Regulatory Commission permit Duke Power Company to

^{1/} Riley, pp. 11-16.

^{2/} Ranson, p. 6.

charge its customers for the estimated cost of disposing of spent nuclear fuel. In any event, the ratemaking statutes of the regulatory bodies which regulate Duke as a utility will permit recovery of reasonable operating expenses which will include decommissioning costs.^{1/}

55. Applicant's decommissioning estimates are based on assumed mothballing-delayed dismantling type of decommissioning. At the present time, further decommissioning studies are being conducted on cost estimates on decommissioning and maintaining the shutdown of a facility in a safe condition. These are not yet complete, however. Applicant points to the cost estimates set forth in the Atomic Industrial Forum (AIF) study, dated November, 1976 entitled, "An Engineering Evaluation of Nuclear Power Reactor Decommissioning Alternatives," as reasonable for units the size and type of those at the McGuire facility. The American Industrial Forum (AIF) study estimates an initial cost of 2.3 million dollars (in 1975 dollars) plus \$167,000 per year for maintenance and surveillance costs if a 24-hour manned security force is required and \$88,000 per year if it is not for the mothballing alternative. The entombing alternative was estimated at 7.5 million dollars (in 1975 dollars) plus \$58,000 per year for periodic inspections and maintenance, while the dismantling alternative was estimated to cost 26.9 million dollars (in 1975) dollars) with no annual costs.^{2/}

^{1/} Ranson, pp. 7-8.

^{2/} Staff Exhibit C, SER Supplement No. 1, pp. 20-1 and 20-2.

Combinations of these three primary decommissioning alternatives could be undertaken by Duke. The Battelle Northwest Laboratory studies concluded that the cost estimates developed by the Atomic Industrial Forum appear to be realistic.^{1/}

56. We find that there is an acceptable means of funding decommissioning during the lifetime of the facility in the recognition of negative salvage value and utilization of depreciation rates to provide cash flow over the life of the plant.^{2/} Mr. Gittleman was cognizant of the decommissioning costs projected by the Battelle Northwest Study^{3/} and was of the view that Applicant would be in a position to finance such costs.^{4/}
57. Accordingly, we find that there is reasonable assurance of the Applicant obtaining the necessary funds to cover the estimated costs of the activities contemplated under the license. Duke Power is financially qualified to operate and, if necessary, shut down and safety maintain the McGuire Nuclear Station, Units 1 and 2.^{5/}

^{1/} Ibid, p. 20-2.

^{2/} Tr. 2120.

^{3/} Tr. 2121-22.

^{4/} Gittleman, p. 4; Tr. 2148-49.

^{5/} Ibid.

IV.
Uranium Fuel Cycle --
Health Effects and Radon-222

A. Health Effects

58. On January 25, 1977, the Appeal Board stated in its Hartsville decision^{1/} that in consideration of alternative sources of energy, focus should be placed upon environmental factors. The Appeal Board makes specific reference to: "An estimate of the incremental incidence of various diseases and genetic effects which would be caused by the operation of each type of plant."^{2/}
59. In conformance with the Appeal Board's decision, both Applicant and Staff presented testimony regarding health effects associated with nuclear and coal-fired generation.^{3/} Applicant's testimony was directed to the health impact to the population within fifty miles of the plant, and showed that health effects attributable to nuclear generation were at least 360 times less than health effects associated with operation of comparable coal units. With respect to comparisons of health effects associated with the entire fuel cycles, Applicant stated that the health effects of the coal-fuel cycle, including occupational effects and effects among the general public as well, are at least thirty times, and probably one-hundred times or more greater than that of the equivalent nuclear fuel cycle.^{4/}

^{1/} Tennessee Valley Authority (Hartsville Nuclear Plant, Units 1A, 2A 1B and 2B) ALAB-367, 5 NRC 92, (January 25, 1977).

^{2/} See Hartsville, supra, fn. 52, at 102-104.

^{3/} Testimony of Lionel Lewis ("Lewis") following Tr. 1713 and Testimony of R. L. Gotchy ("Gotchy") following Tr. 1687.

^{4/} Lewis, p. 8, following Tr. 1713.

The Staff testified that the coal-fuel cycle alternative may be more harmful to man by factors of four to two-hundred fifty, depending upon the health effect being considered for an all nuclear economy, or factors of three to twenty-two with the assumption that all of the electricity used by the uranium fuel cycles comes from coal-powered plants.^{1/}

60. Prior to the evidentiary hearings on the environmental matters held in this proceeding in April of 1977, the Commission on March 7, 1977 announced the adoption of a final interim fuel cycle rule (43 Fed. Reg. 13803; March 14, 1977). We have evaluated the added environmental impacts that would be assumed from the use of the values set forth in revised Table S-3, and find that they do not tip the cost-benefit balance against operation of the McGuire facility.^{2/}
61. There are insignificant increases in the number of acres of land temporarily committed and in millions of gallons of water used.^{3/} There are insignificant increases in non-radiological effluents and in radiological releases and dose commitment.^{4/} The fuel cycle effects presented in the revised Table S-3 promulgated by the interim fuel cycle are

^{1/} Gotchy, p. 11, following Tr. 1687.

^{2/} Testimony of Oliver D. T. Lynch ("Lynch") following Tr. 1779, "NRC Staff Evaluation of the Impact of Revised Table S-3 Values on the McGuire Unit, Nos. 1 and 2 Cost-Benefit Balance," pp. 7-8.

^{3/} Ibid., p.2-3, 5.

^{4/} Id., p.3-7.

sufficiently small -- insignificant -- when they are superimposed on the other assessed environmental impacts associated with McGuire, Units 1 and 2, and clearly do not tilt the cost-benefit balance set forth in the FES.^{1/} Therefore, the cost-benefit balance favors granting the operating licenses. The above finding that the cost-benefit balance favors granting the operating license is based on our consideration pursuant to the Commission's April 11, 1978 rulemaking, that the value for radon-222 in Table S-3 of the final interim fuel cycle rule was in error, and has been corrected. Our determination, as it is affected by the value for radon-222, is based on the new evidence on radon releases and on health effects resulting from radon releases.

^{1/} Id., p. 7-8.

B. Radon-222

62. On April 11, 1978, the Commission amended Interim Table S-3 which summarizes the environmental effects of the uranium fuel cycle to delete the value reported therein for the release of radon-222 (published at 43 Fed. Reg. 15613 [April 11, 1978]). The reason for deleting radon-222 from Table S-3 was that "new estimates of releases have been devised that require upward revision for the value in Table S-3". (43 F.R. 15614). The Commission directed that in proceedings pending before Licensing Boards, the record on NEPA issues be reopened for the limited purpose of receiving new evidence on radon releases and on health effects resulting from radon releases (43 F.R. 15616).
63. On July 20, 1978, in response to the Commission's directive, this Board reopened the record on the issue of radon-222 emissions. We adopted a procedure^{1/} similar to procedures set by the Atomic Safety and Licensing Appeal Board in seventeen cases pending before it.^{2/} These procedures provided for use of the record in the Perkins^{3/} construction permit proceeding as the "lead case" to implement

^{1/} "Memorandum and Order Regarding Procedures for Consideration of Radon Emissions (July 20, 1978)."

^{2/} Philadelphia Electric Company et al. (Peach Bottom Atomic Power Station, Units 2 and 3), ALAB-480, 7 NRC 796, 804-806 (1978); See also, Long Island Lighting Company (Jamesport Nuclear Power Station, Units 1 and 2), ALAB-481, Memorandum and Order, 7 NRC 807, 809 (1978).

^{3/} Duke Power Company (Perkins Nuclear Station, Units 1, 2, and 3), Docket Nos. 50-488, 50-489, 50-490.

consideration of the radon-222 matter.^{1/} The procedures adopted by this Licensing Board, which were a modified version of the ALAB-480 procedures, provided a full and reasonable opportunity to the parties to supplement, contradict, or object to the record in Perkins.^{2/}

We denied the Applicant's motion to rely strictly on the Perkins record.^{3/} We granted the Staff's motion to supplement the

record by the additional testimony of Dr. Gotchy.^{4/} This Board granted in part and denied in part Intervenor's motion to supplement, contradict, or object to the record in Perkins. We found that when the

Commission reopened the proceedings on radon-222 in pending licensing cases it did so for the limited purpose of receiving new evidence on radon releases and the health effects resulting from radon releases.

The Commission did not extend the consideration of health effects to a moral and ethical or philosophical discussion of releases in the fuel cycle.^{5/} We determined that we did not require the assistance of an expert to appreciate the meaning of any increased mortality caused by any increase in radon-222 releases.^{6/} The intervenor cross-examined Dr. R. L. Gotchy on his assessment of the nuclear health effects versus the coal health effects with respect to the substantial differences between

^{1/} Since the Perkins units will have a greater Annual Fuel Requirement (AFR) than the McGuire units, the environmental impact of the fuel cycle for Perkins would be greater. Accordingly, the Board has utilized the Perkins record as an upperbound for purposes of reaching its conclusions as applied to the McGuire proceeding.

^{2/} Tr. 2195.

^{3/} Tr. 2195.

^{4/} Tr. 2196.

^{5/} Tr. 2196.

^{6/} Tr. 2196.

Dr. Gotchy's earlier McGuire testimony^{1/} and Dr. Gotchy's affidavits of March 1978 and May 10, 1978.^{2/} The Intervenor was permitted to challenge by way of cross-examination Dr. Gotchy's assumption behind a 1,000-year cutoff date for consideration of radon-222 releases and associated impacts.^{3/}

64. The Board also determined that the Intervenor had failed to set forth in detail the respect in which the Perkins record is deficient.^{4/} The Board received the entire Perkins record on radon-222, as identified in the Board's Order of July 20, 1978, into evidence in this proceeding, together with all pleadings by the parties commenting on that record. In accordance with our ruling at the hearing, the record is supplemented by the additional evidence added through cross-examination of Dr. Gotchy.^{5/}
65. We turn now to our findings based on the record compiled in this proceeding (i.e., the Perkins record, and as modified and supplemented at the McGuire hearings held on August 30, 1978 on the radon-222 matter.)

^{1/} Supplemental Testimony Regarding Health Effects Attributable To Coal and Nuclear Fuel Cycle Alternatives, following Tr. 1687.

^{2/} Submitted in the Perkins record. The admission of Dr. Gotchy's May 10, 1978 affidavit was discussed extensively at the hearing, but its admissibility was not ruled on by this Board. Tr. 2348-69. Dr. Gotchy's May 10, 1978 affidavit is admitted into evidence in this proceeding.

^{3/} Tr. 2196.

^{4/} Tr. 2196-97.

^{5/} Tr. 2197.

In connection with the Perkins hearing, the Staff filed a series of five affidavits^{1/} which included, as more fully discussed below, the Staff's most recent estimates of radon-222 releases from mining and milling operations and an evaluation of the health effects resulting from such releases. At the Perkins hearing, in addition to the evidence of the Staff witnesses, the Applicant (also Duke Power Co.) in Perkins presented evidence through a panel of witnesses.^{2/} The Applicant and Staff witnesses who appeared and testified at the Perkins hearing are well-qualified experts in their respective disciplines and the Board accords substantial probative weight to their testimony.

66. The Perkins Intervenors obtained the services of Dr. Chauncey Kepford; a former assistant professor of chemistry, who had participated in questions concerning radon-222 emissions in the Three Mile Island proceeding. Dr. Kepford's evidence was obtained at a deposition held on June 8, 1978 in Bethesda, Maryland. At the deposition, Dr. Kepford's prefiled direct testimony was accepted into evidence.^{3/} Dr. Kepford also introduced a handwritten document entitled, "Resource Consumption"^{4/} and some eleven other documents, or parts of documents^{5/} which had not been prefiled. The Resources Consumption document projects uranium availability and consumption. Exhibits H, I, and J are NRC Staff

^{1/} Fg. P-Tr. p. 2369. References to "P-Tr." refer to the transcript page in the Perkins record.

^{2/} Lewis, Goldman, Hamilton, Fg. P-Tr. 2266.

^{3/} P-Tr. p. 2715.

^{4/} P-Tr. p. 2713.

^{5/} P-Tr. p. 2716-2724.

documents relating to amendments of the values set forth in Table S-3. Four documents relate to health as affected by radiation. One concerns earth science problems associated with the disposal of radioactive wastes and another is an extract from the Reactor Safety Study, WASH-1400. Since Dr. Kepford has no expertise in the substantive fields covered by the exhibits he offered, no cross-examination of Dr. Kepford upon his exhibits was made by the other parties. The Applicant in Perkins objected to receipt into evidence of "Resources Consumption" and the eleven exhibits, marked for identification as Exhibits A-J, upon the basis of untimely filing, as being beyond the scope of the Perkins Board's reopening of the record which is to establish a radon-222 value for the uranium fuel cycle as it related to the proposed Perkins facility.^{1/} The Staff also opposed admitting these documents as evidence on the ground that the authors of those documents were not available for cross-examination.^{2/}

67. This Board accepts Dr. Kepford's prefiled direct testimony, as corrected at the Perkins deposition, as evidence. We also admit all other exhibits proffered by Dr. Kepford as evidence insofar as they relate to the amount of radon-222 emitted into the environment as a consequence of the nuclear fuel cycle.^{3/}

^{1/} P-Tr. p. 2726.

^{2/} P-Tr. p. 2728.

^{3/} See, Illinois Power Co. (Clinton Power Station, Units Nos. 1 and 2), ALAB-340, July 29, 1976, 4 NRC 27, at 31).

68. Among the Staff affidavits submitted in the Perkins record were two affidavits, those of Rothfleisch and Lowenberg, which principally described how the earlier (erroneous) value of 74.5 curies per AFR was derived for the documents which formed the background for the original promulgation of Table S-3. The Perkins Board inquired into these background matters to some degree. However, except for Dr. Kepford's assertions related to the Nuclear Regulatory Commission as a whole -- there was no assertion that the prior incorrect value adversely reflected on the credibility of the evidence and witnesses offered by the Staff in this reconvened proceeding.

Radon Source Terms

69. The questions posed by the inquiry into overall impact and overall cost-benefit considerations associated with potential radon release from the nuclear fuel cycle raise a number of difficult questions. The first questions relate to the various sources of radon in the fuel cycle. Radon is one of the natural products of the radioactive decay of uranium-238 precursors including a number of long-lived isotopes: uranium-238, half life 4.5 billion years; thorium-230, half-life 80,000 years; and radium-226, half-life 1600 years. Radon-222 itself once generated has a short half-life, approximately four days.^{1/}

70. One source of radon release to the atmosphere is the mining process. The Staff witness, Wilde, in his affidavit, estimated the radon release from underground mining operation to amount to some 4,060 curies per

^{1/} Fig. 3, Supplemental Affidavit of R. L. Gotchy, dated May 10, 1978 (Fg. P-Tr. 2425).

AFR. ^{1/} This value was accepted as reasonable by Applicant's witnesses ^{2/} and was not challenged by Intervenors. The background and qualifications of Mr. Wilde and of Applicant's Perkins witnesses who have accepted Mr. Wilde's value as reasonable give the Board a confident basis for accepting this value as an estimate of the release rate from underground mining. The Perkins Board, however, was concerned that abandoned mines could continue to be a source of radon release to the atmosphere and questioned Mr. Wilde concerning this. Mr. Wilde, however, indicated that it was industry practice to seal ventilation and hoisting shafts for mines no longer producing uranium. Moreover, even if the shafts were not sealed when the ventilation fans are shut down, radon release would essentially go to zero. ^{3/} Mr. Wilde's affidavit indicated that there was insufficient data to predict with certainty the potential rate of radon emission from open-pit mining operations. ^{4/} Although open-pit mining operations constitute about half of the present uranium mining activity ^{5/} and may be anticipated to become a decreasing portion in the future, ^{6/} the Perkins Board was nevertheless concerned by the absence of any estimates of potential radon released from open-pit mining operations. ^{7/} At the request of the Perkins Board, Mr. Wilde made a number of conservative assumptions and calculated a value for radon release from open-pit mines, of approximately 100 Ci per year per AFR. ^{8/} Perkins Applicants' witness Goldman indicated he made similar calculations

^{1/} Wilde, p. 5, fg. P-Tr. 2369.

^{2/} Goldman testimony, para. 1 following P-Tr. 2266 and Tr. 2281.

^{3/} P-Tr. 2541-2542.

^{4/} Wilde, p. 7, fg. P-Tr. 2369.

^{5/} P-Tr. 2543.

^{6/} P-Tr. 2551.

^{7/} P-Tr. 2543-2558.

^{8/} P-Tr. 2609-2613.

and reached similar results.^{1/} However, he testified that of the states in which significant open-pit uranium mining takes place, a number have requirements for reclamation and recontouring.^{2/} Mr. Wilde's estimate was not challenged by Perkins Intervenor's witness Kepford or by Intervenor's in this proceeding. Indeed, it appears to have been adopted by Dr. Kepford for purposes of calculations which he subsequently performed in connection with testimony he gave at his deposition.^{3/}

71. Giving consideration to the conservative value of the assumptions used by Mr. Wilde, and giving due consideration to Mr. Wilde's qualifications and qualifications of Applicant's Perkins witnesses who have agreed with Mr. Wilde's testimony, the Board finds that an estimate of potential radon releases from open-pit mining of 100 Ci per year per AFR represents a conservative estimate of the potential radon release from the process of open-pit mining.
72. After the mining operation, uranium ore is delivered to a mill where it undergoes the various chemical processes which result in the separation of uranium from the other materials contained in the ore.^{4/} At the mill, there are a number of potential points of radon release. One point is the stockpile where the ore awaits processing.^{5/} There will be some generation of radon during this storage period. Staff witness Magno

^{1/} P-Tr. 2604.

^{2/} P-Tr. 2639.

^{3/} Kepford, p. 2.

^{4/} P-Tr. 2502-2505.

^{5/} P-Tr. 2502.

testified that this was considered in developing his estimates but proved to be only a very minor contribution and was not included in the overall estimates.^{1/} During the course of milling, there will be the release of some radon as a result of crushing and grinding and various chemical processing steps. Staff witness Magno estimated that this release would amount to some 30 curies per AFR.^{2/} Thereafter, the tailings or residual material remaining after the uranium has been extracted (which contain substantial amounts of the thorium and radium) go to a tailings pile.^{3/} Mr. Magno provided separate estimates for radon release from the tailings piles during different periods during and following active milling.

73. Mr. Magno's testimony provides an estimate of approximately 750 curies of radon per AFR released from the tailings during the period of active mill operation, which he took as 26 years of mill operation. During this period of time, a portion of the tailings pond is composed of wet pond area, wet sandy beach areas, and some dry beach areas. Radon is released principally from the dry beach areas.^{4/}
74. Mr. Magno estimated that during the following period of approximately five years during which the tailings piles dry out and are stabilized, approximately 350 curies per AFR would be generated.^{5/}

1/ P-Tr. 2559-2560.

2/ Magno, p. 2-3, fg. P-Tr. 2369, Tr. 2560.

3/ P-Tr. 2505-2506.

4/ Magno, p. 3-4, fg. P-Tr. 2369 and P-Tr. 2561-2562.

5/ Magno, p. 6, fg. P-Tr. 2369.

Mr. Magno's values of 750 and 350 curies per AFR for these activities were accepted as reasonable estimates by Applicant's Perkins witness,^{1/} and were not challenged by Intervenor's witness in either Perkins or this proceeding.

75. The principal discussion concerning radon release from tailings piles dealt with the period after plant operation ceased and concerned radon emanating from the dried tailings piles. Mr. Magno estimated the releases from dried stabilized tailings piles to be between 1 and 10 curies per AFR. The tailings pile assumed by Mr. Magno is a pile covered with sufficient overburden to achieve an overall release rate of about twice natural background in surrounding environment. This assumption was based upon a recently developed NRC Staff branch position.
76. Since a number of mills may be located in agreement states and thus are not subject to NRC licensing, the Perkins Board questioned the assumption that all tailings piles would be subject to stabilization requirements such as those described by Mr. Miller as NRC branch positions for NRC licensing purposes. The Staff presented in response to that Board's inquiry Mr. Kerr, Assistant Director for State Agreements in NRC's Office of State Programs. Mr. Kerr testified that the NRC had been in contact

^{1/} Goldman, p. 1, fg. P-Tr. 2266.

with the states in which uranium milling activities are carried out and each of the responsible states has provided the NRC with commitments to impose stabilization requirements equivalent to those described by the Staff.^{1/}

77. There are, of course, some abandoned mills in which there are tailings piles from previous milling activities. These abandoned facilities are no longer under license and may not therefore be subject to stabilization requirements as a part of licensing activities, although there is some indication that some effort in this regard may develop in the future.^{2/} Nevertheless, since these are abandoned facilities, any radon emission from such tailings piles cannot be attributed to the operation of the Perkins facility.

78. In light of the testimony provided to the Perkins Board by the Staff, this Board finds that it is reasonable to assume, for purposes of estimating radon release from uranium milling activities that may be associated with the production of fuel for the McGuire facility, that mills will be subject to stabilization requirements and that the estimate of from 1 to 10 curies per year per AFR for radon releases from stabilized tailings piles provided by Mr. Magno is reasonable.^{3/}

^{1/} P-Tr. 2477-2480, 2483-2485.

^{2/} P-Tr. 2453-2455, 2480-2481.

^{3/} Since the Perkins units will have a greater Annual Fuel Requirement (AFR) than the McGuire units, the environmental impact of the fuel cycle would be greater for Perkins. Accordingly, the Board has utilized the Perkins record as an upperbound for purposes of reaching its conclusions as applied to this proceeding.

Of course, as indicated by Mr. Magno and Mr. Miller, there may be some uncertainty as to stability over very long periods of time. Mr. Magno indicated that stabilized piles will retain integrity over periods of "at least several hundreds of years...."^{1/} Mr. Miller mentions uncertainty involving "thousands and thousands of years"^{2/}. To provide information concerning potential radon release from a tailings pile if all of its cover material were removed as a result of erosion processes over long periods of time, such as a thousand years, Mr. Magno estimated a release rate of some 110 curies per year per AFR.^{3/} These values were accepted as reasonable by Applicant's Perkins witness^{4/}, and were not challenged by Dr. Kepford. Indeed, Dr. Kepford appears to use this value for purposes of his computations.^{5/} Dr. Kepford, however, assumed no stabilization at all and assumed the higher rate mentioned by Mr. Magno from the outset of his computation period.^{6/}

Projection of Impact Into The Future

79. The most difficult question posed by the radon inquiry is the determination of how long into the future must one attempt to predict effects of present actions for NEPA purposes and how long into the future can one reasonably predict impact potential.

^{1/} Magno, p. 9, fg. P-Tr. 2369.

^{2/} P-Tr. 2402, see also Tr. 2396.

^{3/} Magno p. 10, fg. P-Tr. 2369.

^{4/} Goldman, p. 1, fg. P-Tr. 2266.

^{5/} Kepford, pp. 2-3.

^{6/} Kepford, p. 2.

As pointed out above, uranium-238 and other elements in the radioactive decay chain leading to the emanation of radon are very long-lived radioactive materials. There is no dispute that radon emanation will continue for many eons into the future from such activities as an abandoned open pit which is not backfilled or flooded. Similarly, the tailings pile (unless deeply buried) may emanate radon for many thousands of years into the future supported by the decay of 80,000-year, half-life thorium-230. The rate which it will diffuse to the atmosphere is dependent upon the specific conditions of stabilization assumed.^{1/} Of course, as Dr. Gotchy's testimony points out, the potential for intervening climatic changes over very long periods of time, tens of thousands of years to hundreds of thousands of years, (or perhaps, sooner), which can have significant effect upon the earth environment and can indeed cover over, disperse, or otherwise affect the sources of radon released to the environment.^{2/} However, outside of these serious climatic changes, what we are faced with is essentially a permanent, albeit small, continuing release of radon to the atmosphere resulting from the milling and mining of uranium for the operation of the McGuire plant or any other uranium fueled lightwater power reactor. This low-level release can be the source of an increase, albeit extremely small, in overall radiation exposure to populations living now and populations living in the future, including those living in the very distant future. The difficult question which faces us is how to assess these future potential exposures. The record in this case we think provides an ample exposition of three very different points of view.

^{1/} See Magno, p. 8 and 10, fg. P-Tr. 2369.

^{2/} Gotchy, p. 13 fg. P-Tr. 2396, Gotchy Supplemental Testimony IV-6 - IV-13, fig. 4, fg. P-Tr. 2425, P-Tr. 2426-2434.

80. On the one hand, the Staff offered the testimony of Dr. Reginald Gotchy. Dr. Gotchy, using the release values derived from the evidence of Messrs. Wilde and Magno, made some simplifying assumptions for ease of calculation. For example, as outlined above, Mr. Magno's testimony indicates that the tailings piles will be stable for periods of hundreds of years with release rates of approximately 1 to 10 curies per year. Mr. Magno also indicated that release rates, in the event that the covering material were eroded, could be as much as 110 curies per year per AFR. Dr. Gotchy, for his calculation, assumed that the pile remains stable for its first 500-year period releasing 1 Ci per year per AFR for the first 100 years. He then assumed loss of some overburden covering the tailings which then released 10 curies per year per AFR for the next 400 years. Then, promptly at the end of that 500-year period, Dr. Gotchy assumed as a step change the essentially complete loss of overburden resulting in a release rate thereafter of 100 curies per year per AFR.^{1/} Based on these rates of release, Dr. Gotchy then calculated the dose to a stable U. S. population of approximately 300 million for various periods of time after the stabilization of the pile out to 1,000 years.^{2/} Dr. Gotchy also calculated the population doses assuming releases as described for the periods up to 10,000 years into the future for purposes of comparing potential doses with background doses for radon.^{3/}

81. Dr. Gotchy, using identified dose conversion factors, then computed a projected risk of cancer mortality which would be attributable to additional radiation exposure associated with this additional radon

^{1/} Gotchy, p. 4, fg. P-Tr. 2369 and Tr. 2405.

^{2/} Gotchy, p. 3-5, fg. P-Tr. 2369.

^{3/} Gotchy, p. 15, fg. P-Tr. 2369.

burden in the atmosphere out to 1,000 years into the future. Dr. Gotchy estimates that the additional risk of cancer mortality deaths resulting from the cumulative assumed radon release for 1,000 years will cumulatively total 1.2 additional deaths per AFR.^{1/}

82. Dr. Gotchy subsequently added this additional risk to his previous estimate of health effects associated with the nuclear fuel cycle and compares them with his previous estimate of health effects associated with the coal fuel cycle.^{2/} Dr. Gotchy estimates that, considering the impact of radon at the higher release rates presently estimated by the Staff for a period of 1,000 years, the overall estimate of excess mortality associated with one AFR for the all nuclear fuel cycle would range from 0.59 to 1.7 per year. This is contrasted with the estimate of excess mortalities for one AFR for the coal-fuel cycle ranging from 15-120 per year.^{3/}

83. Dr. Gotchy testified at the McGuire hearing that his calculations were based on an average prevailing wind speed for his simple wedge model for calculating the dispersion of the radon plume from a mine or tailings piles as it moves across the U.S. at about two meters per second.^{4/} The two meters per second assumed was said to be the average wind speed

^{1/} Gotchy, p. 8, fg. P-Tr. 2369.

^{2/} Gotchy Supplemental Affidavit, Table 1, 1a, 2, 2a, fg. P-Tr. 2425.

^{3/} Gotchy Supplemental Affidavit, Table 1, fg. P-Tr. 2425.

^{4/} Tr. 2379.

within the mixing depth.^{1/} Dr. Gotchy could not say with certainty that this is the representative of the mean rate of transport of radon emissions from the region of origin across the country.^{2/} The two meters per second average prevailing wind speed corresponds to about 4.5 miles per hour, which is on the order of about 100 miles a day.^{3/} Dr. Gotchy was also asked to assume that the wind velocity at the Charlotte weather bureau at 7:00 a.m. on a day in August was five knots at ground level and, that at 3,000-feet it was at 15 knots.^{4/} Dr. Gotchy testified, however, that his estimates of the population dose and health effects have at least an order of magnitude uncertainty in them.^{5/} He concluded, therefore, that the variations in the assumptions of wind speed fell within the envelope of the impacts of the calculations contained in his simple wedge model ^{6/} In short, variation of the windspeed from five knots to 15 knots at 3,000 feet would not significantly affect Dr. Gotchy's calculations because according to Mr. Riley's own calculations the maximum dose possible would only be about 26 percent higher than the Staff estimates. Such variations fall within the large uncertainties in such estimates.^{7/}

1/ Tr. 2379
2/ Tr. 2380.
3/ Tr. 2380
4/ Tr. 2381-82.
5/ Tr. 2381 -83
6/ Tr. 2381 -83
7/ Tr. 2378.

84. Dr. Gotchy concludes that the increase in health effects due to radon out to 1,000 years into the future does not significantly alter his conclusion that the nuclear fuel cycle has far fewer adverse health effects than a comparable coal fuel cycle.^{1/} Dr. Gotchy's testimony discusses at length his reasons for his conclusion that he cannot meaningfully predict specific health effects into the future beyond 1,000 years.^{2/}

85. Dr. Gotchy further shows that on another basis, one can conclude that the radon release from the nuclear fuel cycle does not have a significant adverse

^{1/} Gotchy Supplemental Affidavit, Enclosure 5, fg. P-Tr. 2425; P-Tr. 2592-99.

^{2/} Gotchy, p. 11-13, fg. P-Tr. 2369; Gotchy Supplemental Affidavit IV-1 - IV-20, fg. Tr. 2425.

impact. Dr. Gotchy compared radon releases resulting from the mining and milling of uranium with radon naturally occurring on the earth, and provided calculations out to 10,000 years of the comparative population exposure resulting from radon emanation from the nuclear fuel cycle compared to the naturally occurring exposures. These calculations show that exposure due to radon release from mining and milling are insignificant compared to natural background radiation exposures.^{1/}

86. In sharp contrast is the position of Dr. Kepford. Dr. Kepford agreed that "These problems [famines, plagues, nuclear wars, major technological advances, the collapse of technologies, ice ages, and a myriad of other unknowns] make any attempt at an accurate prediction of what our society will resemble 20, 50, or 100 years from now sheer fantasy."^{2/} Nevertheless, using Dr. Gotchy's health effects values,^{3/} and using radon release rates somewhat different from Dr. Gotchy's, but basically derived from the Staff's testimony,^{4/} Dr. Kepford projects numbers of deaths from future radon emanations from uranium mining and milling far into the future: 10,000 years, 100,000 years; millions of years and billions of years into the future.^{5/} Dr. Kepford's calculations

^{1/} Gotchy, p. 13-16, fg. P-Tr. 2369.

^{2/} Kepford, p. 2.

^{3/} Kepford, pp. 3 and 5.

^{4/} Kepford, p. 2, P-Tr. 2788-2789.

^{5/} Kepford, Table 4.

are based on his model "which freezes the present society as we know it, with its habits and characteristics, and extends this society, for better or worse, off to infinity."^{1/} Out to 1,000 years, Dr. Kepford's calculations are somewhat higher than those resulting from the use of Dr. Gotchy's estimates. For 1,000 years, Dr. Kepford estimates a total of 489 deaths due to the radon resulting from approximately 110 AFRs required to fuel the three Perkins facilities [or the two McGuire facilities] for a 30-year operating lifetime.^{2/} For the same number of annual fuel requirements, Dr. Gotchy's estimates to 1,000 years predict approximately 132 deaths. It should be noted that Dr. Kepford's calculations contain certain radon source estimates greater than those contained in Dr. Gotchy's estimates. These include a source of 100 curies per year per AFR, to account for residual releases from open-pit mines.^{3/} Dr. Kepford assumes no stabilization of mill tailings piles and thus assumes a release of approximately 110 curies per year per AFR for the entire period.^{4/} As noted above, Dr. Gotchy's estimates for 1,000 years are based upon a release from the tailings piles for the first 500 years of approximately 110 curies per AFR and 100 curies per AFR for the 500 years that follow (consistent with Magno's affidavit).

^{1/} Kepford, p. 1.

^{2/} Kepford, Table 4, P-Tr. 2790, 2791.

^{3/} Kepford, p. 2.

^{4/} Kepford, p. 2, P-Tr. 2791.

In contrast to Dr. Gotchy, Dr. Kepford continues his computations of health effects on the same basis, for periods to millions and billions of years. On this basis, of course, although annual increment is small, the total period of time is so enormous that the total number of impacts summed over this period of time, as computed by Dr. Kepford, seems large, e.g., the impact accumulated for 10,000 years is 4800 computed deaths, for a billion years it is 230 million computed deaths.^{1/} It is this impact that Dr. Kepford urges us to debit nuclear power when assessing nuclear power vs. an impact associated with coal.^{2/}

87. A third and different point of view was expressed by Applicant's Perkins witness Dr. Hamilton who, although agreeing that Dr. Gotchy's estimates were reasonable and conservative based upon the data he used,^{3/} felt that calculating health effects based upon such extremely low level exposure was not truly meaningful as repair mechanisms were not taken into account.^{4/} Dr. Hamilton also decried extrapolations of health effects into the distant future as being misleading.^{5/}

88. Rather, Dr. Hamilton expressed the view that the problem should be addressed in terms of increase in Radon-222 that a person is going to

^{1/} Kepford, Table 4.

^{2/} Kepford, p. 6.

^{3/} Hamilton testimony page 1 following P-Tr. p. 2266, and Tr. p. 2270.

^{4/} P-Tr. p. 2271.

^{5/} P-Tr. p. 2275.

get from the nuclear fuel cycle in terms of the fractional increase in natural background radiation from Radon-222 to which every living person is exposed.^{1/} Dr. Hamilton concluded that the average annual dose to the bronchial epithelium from Radon-222 from natural sources is 165 millirad per year.^{2/} Dr. Hamilton calculated that one year's operation of a 1000 MWe nuclear power plant at 0.65 capacity factor would increase natural background Radon-222 by $1.5E-7$ or an increased dose to the bronchial epithelium of $2.5E-4$ millirem per year.^{3/} Dr. Hamilton considered that increases in Radon-222 of this magnitude "make an additional negligible contribution to annual natural background radiation and consequently, a similarly negligible impact on the health effects associated with the fuel cycle."^{4/}

89. In response to questioning by the Perkins Board, Dr. Hamilton testified that variations in normal living style, traveling about the country; going indoors or outdoors result in doses that are many orders of magnitude greater than the increase in dose resulting from Radon-222 emanating from tailings.^{5/} Dr. Hamilton concluded that these low levels of exposure

^{1/} P-Tr. p. 2275.

^{2/} P-Tr. p. 2276.

^{3/} P-Tr. p. 2277.

^{4/} Hamilton testimony pp. 2 and 3 following P-Tr. p. 2266.

^{5/} P-Tr. pp. 2322 and 2333.

are "completely insignificant and without any reality".^{1/} For comparison, Dr. Hamilton^{2/} referred to some calculations provided by Mr. Goldman which compared radon exposure from natural outdoor background radiation to that from background to persons indoors. These calculations show that the entire lung dose projected for 500 years could be offset by reducing the average time spent indoors by the U.S. population by less than 10 minutes over a 500-year period.^{3/} Dr. Hamilton's main thrust was to consider each individual person over the years of his lifetime and consider the insignificant additional dose due to Radon-222 from the uranium fuel cycle.^{4/} He clearly stated that increasing natural radon dose by $10E-7$ was not creating an additional health hazard.^{5/}

90. This Board has weighed carefully these views, which basically are not different presentations of factual evidence but basically constitute different views as to the proper treatment of projections of potential effects into a distant future. On the basis of the evidence considered by this Board, we conclude that attempts to project health effects into the very distant future in terms of quantitative estimates of specific incidence of various diseases or mortality are not truly meaningful. An element of the Board's conclusion derives from the fact that while there are extensive attempts on the record to calculate in minute detail the

^{1/} P-Tr. 2323.

^{2/} P-Tr. 2322.

^{3/} Goldman, p. 8-10, fg. P-Tr. 2266.

^{4/} P-Tr. pp. 2278, 2280 and 2323.

^{5/} P-Tr. p. 2323.

potential impact from minute radon releases from the nuclear fuel cycle into the very distant future, there remains an unknown of unquantified portions, based upon the record available to this Board, concerning long-term impacts attributable to releases of toxic materials over long periods of time from the coal fuel cycle,^{1/} and other uncertainties, such as long-term transport of acid sulfates.^{2/} In light of these uncertainties in the impacts associated with the coal fuel cycle, it appears to have little meaning to make concededly artificial assumptions concerning the potential for future long-range impacts associated with the nuclear fuel cycle.

91. Based on the record available to the Board, we find that the best mechanism available to characterize the significance of the radon releases associated with mining and milling the nuclear fuel for the McGuire facility is to compare such releases with those associated with natural radon background. In this connection, the Board finds that the evidence demonstrates that the exposures associated with the radon release from the mining and milling of the uranium are insignificant. We do, however, believe that the attempt by the Staff to quantify these impacts for at least a period of time for which reasonable future projections can be made; that is, a period of approximately 100 to 1,000 years into the

^{1/} Goldman, 8 fg. P-Tr. 2266, P-Tr. 2640, 2641.

^{2/} P-Tr. 2316.

the future is desirable for the purposes of assessing relative health impacts of the nuclear and coal fuel cycle. Dr. Gotchy's effort to carry out these calculations out to approximately 1,000 years into the future is useful and, until a definitive determination can be made by the Commission, we believe that the use of a 1,000-year figure for purposes of estimating the potential health impacts associated with the release of radon for purposes of comparison with the available information concerning impacts associated with the coal fuel cycle has been beneficial.

Conclusion as to Health Effects of
Radon-222 (and Carbon 14) Released by
the Uranium Fuel Cycle

92. In response to the Commission's directives contained in the statement of consideration issued in connection with the clarifying amendment to Table S-3 of 10 CFR Part 51, published in the Federal Register on April 14, 1978, (43 F.R. 15613), this Board has carefully considered available information concerning the releases of radon-222 (and Carbon 14) associated with the uranium fuel cycle and health effects that can reasonably be deemed associated therewith. We conclude that such releases and impacts are insignificant in striking the cost-benefit balance for the McGuire Nuclear Facility, Units 1 and 2. ^{1/}

^{1/} On July 14, 1978, in its Partial Initial Decision, Environmental Consequences of the Uranium Fuel Cycle, the Perkins Licensing Board found that releases of radon-222 associated with the uranium fuel cycle and health effects that can be reasonably associated with those releases are insignificant in striking the cost-benefit balance for the Perkins Nuclear Power Station. Perkins *supra*, Slip opinion, p. 29.

V.
Conclusions of Law and Decisional Conditions^{1/}

93. We have thoroughly reviewed and evaluated the evidence submitted by all parties with respect to the contentions raised by the Carolina Environmental Study Group. The Board has evaluated the Staff's final environmental statement and the Applicant's environmental report, the written testimony of Staff, Applicant, and CESG witnesses, as well as the answers elicited from these witnesses in response to questions of the Licensing Board and the parties. The Board has examined the other evidence presented by the parties in form of exhibits (see Appendix A).

94. We make the following conclusions of law with respect to the contentions of the Carolina Environmental Study Group, in accordance with the Commission's regulations, particularly 10 CFR Part 2, Appendix A, Sections VIII(b)(7) and VIII(c), respectively:

(1) The requirements of Section 102(2)(A), (C) and (E) of the National Environmental Policy Act have been met;

(2) The requirements of 10 CFR Part 51 have been met;

^{1/}[The NRC Staff's proposed findings of fact and conclusions of law related to the environmental phase were filed in these proceedings on August 26, 1977. The NRC Staff incorporates those findings of fact and conclusions of law by reference.]

- (3) We have thoroughly considered the basis of the analysis and evaluation set forth in the Final Environmental Statement, which weighed the environmental, economic, technical and other benefits against environmental costs and considered available alternatives (pursuant to the direction in 10 CFR Part 2, Appendix A, Sections VIII(b)(7) and VIII(c), respectively), and find that the environmental review conducted by the Commission Staff pursuant to 10 CFR Part 51 is adequate;
- (4) Changes in circumstances since issuance of the construction permits do not tip the cost-benefit balance against issuance of the operating licenses for McGuire, Units 1 and 2. The evaluation includes our assessment of the FES, of the Applicant's compliance with 10 CFR Part 50, Appendix I, of the evaluation of the health effects of coal generation facilities versus nuclear generation facilities, and of the Commission's final interim uranium fuel cycle rule, 10 CFR Part 51.20(e), (Table S-3) as it applies to the McGuire facility;

(5) The Board has determined that full-term, full-power operating licenses for Units 1 and 2 should be issued. The Board considered and decided all matters in controversy among the parties, and independently considered the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken;

(6) The license conditions proposed in the Staff FES at paragraph 7, page iii, should be applicable to the operating licenses. Before engaging in additional construction or operational activities which may result in a significant adverse environmental impact not evaluated or significantly greater than that evaluated in the FES, the Applicant shall provide written notification to the Office of Nuclear Reactor Regulation. The Board has also determined that environmental technical specifications should be established pursuant to the requirements of the Staff as set forth in item 7B(1) through (8) of the Summary and Conclusions at p. iii of the Final Environmental Statement.

95. With regard to the safety issues, the Board concludes that the application for operating licenses and the record of the proceeding contain sufficient information, and that the review of the application by the Staff has been adequate to support the following findings:

96. The Board finds that in accordance with the provisions of 10 CFR §50.91 and 10 CFR §50.57:

- (1) There is reasonable assurance that construction of the facility will be substantially completed, on a timely basis, in conformity with the construction permit and the application as amended, the provisions of the Act, and the rules and regulations of the Commission;
- (2) There is reasonable assurance that the facility will operate in conformity with the application as amended, the provisions of the Act, and the rules and regulations of the Commission;
- (3) There is reasonable assurance (i) that the activities authorized by the operating licenses can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
- (4) The Applicant is technically and financially qualified to engage in the activities to be authorized by the operating licenses in accordance with the Commission's regulations;

(5) The applicable provisions of 10 CFR Part 140 have been satisfied; and

(6) The issuance of the licenses will not be inimical to the common defense and security or to the health and safety of the public.

97. Having considered and decided all matters in controversy among the parties related to operation, the Director of Nuclear Reactor Regulations should be authorized to make such additional findings on uncontested issues as may be necessary to issuance of full-term operating licenses for McGuire Nuclear Station, Units 1 & 2, subject to the conditions referenced above.

VI.
Order

98. WHEREFORE IT IS ORDERED this 2nd day of November, 1978, that the Director, Office of Nuclear Reactor Regulation, is authorized upon making requisite findings with respect to matters not embraced in this Initial Decision in accordance with the Commission's regulations, to issue to Applicant, operating licenses for a term of not more than forty (40) years, authorizing operation of the McGuire Nuclear Station, Units 1 and 2, at steady state power levels not to exceed 3411 megawatts thermal; such licenses may be in such form and content as is appropriate

in light of such findings, provided that such licenses are consistent with the conclusions of the Board herein; and IT IS FURTHER ORDERED, in accordance with Sections 2.754, 2.760, 2.762, and 2.764(a), of the Commission's Rules of Practice, 10 CFR Part 2, that this Initial Decision with respect to the McGuire Nuclear Station, Units 1 and 2, shall be effective immediately and shall constitute, with respect to the matters covered therein, the final action of the Commission forty-five (45) days after the issuance hereof, subject to any review pursuant to the Commission's Rules of Practice. Exceptions to this Initial Decision may be filed by any party within ten (10) days after service of this Initial Decision. A brief in support of the exceptions shall be filed within thirty (30) days thereafter, forty (40) days in the case of the Regulatory Staff. Within thirty (30) days after service of the brief of appellant (forty (40) days in the case of the Regulatory Staff), any other party may file a brief in support of, or in opposition to, the exceptions.

FOR THE ATOMIC SAFETY AND LICENSING BOARD

Dr. Cadet H. Hand, Member

Dr. Emmeth A. Luebke, Member

Dr. Robert M. Lazo, Esq., Chairman

Respectfully submitted,

Edward G. Ketchen
Counsel for NRC Staff

Appendix A (Decisional record)

Dated at Bethesda, Maryland
this 2nd day of November, 1978.

Decisional Record

The decisional record in this proceeding Duke Power Company (William B. McGuire Nuclear Station, Units 1 and 2, Docket Nos. 50-369 and 50-370) consists of the following:

1. The material pleadings filed herein, including the Commission notices, the petitions and other pleadings filed by the parties and the orders issued by the Board during the course of this proceeding.
2. The transcript in this proceeding. The transcript of testimony at the evidentiary hearings is in nine volumes with pagination from 135 to 2673.
3. The exhibits received into evidence at the evidentiary hearing. These exhibits are identified as follows: _____
 - a. The exhibits identified by the NRC Staff in Appendix A to the "NRC Staff's Proposed Findings of Fact and Conclusions of Law in the form of a Partial Initial Decision," August 26, 1977.
 - b. The following additional exhibits:

STAFF EXHIBITS

<u>Number</u>	<u>Identified</u>	<u>Received</u>	<u>Description</u>
B	1975	1975	SER, NUREG-0422
C	1975	1975	SER, Supplement 1, NUREG-0422

APPLICANT EXHIBITS

3	1931	1933	(Amendments 41-55 to License for in- clusion in Applicant Exhibit 3)
---	------	------	---

INTERVENOR EXHIBITS

34	1979	1979	Letter dated August 7, 1978 (Attachment 1)
35	1979	1979	Graph (Attachment 2)
36	2257	2264	<u>Wall Street Journal</u> article of July 31, 1978, page 9.
37	2309		Testimony of Carlos G. Bell
37	2443	2491	Dose versus distance graph
38	2443	2491	Dose versus wind speed representatio:
39	2443	2491	Comparison chart

