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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CONSUMERS POWER COMPANY	)	Docket Nos. 50-329
	)	~~50-330~~
(Midland Plant, Units 1 and 2)	)	

NUCLFAR REGULATORY COMMISSION STAFF'S FINDINGS OF FACT AND CONCLUSIONS OF LAW

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NUCLEAR REGULATORY COMMISSION STAFF'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

I. INTRODUCTION

1. The Consumers Power Company (Consumers) made its initial application for construction permits to construct two pressurized water nuclear reactors at Midland, Michigan, on January 13, 1969. Unit No. 1 is designed to have a gross electrical output of 506 MWe and will also generate large quantities of process steam. Unit No. 2 will have a gross electrical output of 855 MWe. Construction permits were issued to Consumers on December 15, 1972.

2. On July 21, 1976, after review of the orders of the U.S. Atomic Energy Commission granting construction permits for the Midland facility, the Court of Appeals for the District of Columbia Circuit in Nelson Aeschliman, et al. v. U.S. Nuclear Regulatory Commission, 547 F.2d 622 (D.C. Cir., 1976), cert. granted sub nom. Consumers Power Company v. Aeschliman, 45 U.S.L.W. 3570 (February 22, 1977) (Aeschliman) remanded a number of issues to the Nuclear Regulatory

Commission (Commission) for consideration, specifically, the fuel cycle issue adjudicated by the United States Court of Appeals for the District of Columbia Circuit in Natural Resources Defense Counsel, et al. v. U.S. Nuclear Regulatory Commission, 547 F.2d 633, (D.C. Cir., 1976), the issue of energy conservation, the issue of a clarified letter from the Advisory Committee on Reactor Safeguards (ACRS), and the issue of changed circumstances regarding Dow's need for porcess steam.

3. By the Commission's Memorandum and Order of August 16, 1976,[1/] the Commission reconvened the Atomic Safety and Licensing Board (Board) in this proceeding and directed it to consider the fuel cycle issue remanded by the Court of Appeals in accordance with the General Statement of Policy on Environmental Effects of the Uranium Fuel Cycle (41 Fed. Reg. 34707, August 16, 1976 (General Statement of Policy) to determine whether the outstanding construction permits for the Midland Plant should be continued, modified or suspended until an interim fuel cycle rule has been made effective.

4. The mandate in the Aeschliman case issued on September 3, 1976, and upon issuance, the Commission, expanded its instructions to the Licensing Board by its Memorandum and Order of September 14, 1976.[2/] There, the

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1/ Consumers Power Company (Midland Plant, Units 1 and 2), CLI-76-11, NRCI-76/8 65 (August 16, 1976).

2/ Consumers Power Company (Midland Plant, Units 1 and 2), CLI-76-14, NRCI-76/11 474, 475 (November 5, 1976).

Commission directed the Licensing Board to consider all issues remanded to the Commission by Aeschliman.

5. The Commission, by its Memorandum and Order of November 5, 1976,[1/] instructed the Licensing Board to defer its consideration of the fuel cycle issue pending anticipated adoption of an interim fuel cycle rule based on the Commission's decision in Seabrook.[2/] By its Memorandum and Order to the Licensing Board on November 5, 1976, the Commission reaffirmed that the Licensing Board was to continue its inquiry into the remaining Aeschliman issues.

6. The Licensing Board established procedures and scheduled hearings to take testimony on these issues. Hearings commenced in Midland, Michigan, on November 30, 1976.

7. The parties represented at the hearings were Consumers Power Company (Consumers), Dow Chemical Company (Dow), All Intervenors Other Than Dow (Intervenors) and the NRC Staff (Staff).

1/ Consumers Power Company (Midland Plant, Units 1 and 2), CLI-76-11, NRCI-76/11 474, 475 (November 5, 1976).

2/ Public Service Company of New Hampshire, et al. (Seabrook Station, Units 1 and 2), CLI-76-17 NRCI-76/11, 451 (November 5, 1976).

8. After four hearing days, the hearings were moved to Chicago, Illinois, with hearings running intermitently until May 13, 1977, when the record on the suspension question was closed.[1] The Board at the final hearing session ordered all parties to file proposed findings of fact pursuant to its authority under 10 C.F.R. §2.754(a) (Tr. 6160) and requested that the parties brief the legal issues surrounding the suspension question. (Tr. 6162).[2]

9. The interim fuel cycle rule, referred to by the Commission when it instructed the Licensing Board to defer consideration of the fuel cycle, has been issued. (42 Fed. Reg. 13803, March 14, 1977). Accordingly, the Midland Appeal Board has directed the Licensing Board to take up the fuel cycle issue when it restrikes the cost-benefit balance for the Midland facility in connection with the other issues before it at the remand proceeding.[3]

1/ It should be noted that Consumers filed a "Petition for a Writ of Certiorari to the United States Court of Appeals for the District of Columbia Circuit" in the Supreme Court of the United States. On February 22, 1977, the Supreme Court issued an Order granting the petition for certiorari and thereby taking review of every issue remanded for proceedings before the Nuclear Regulatory Commission by the Aeschliman decision. On March 4, 1977, the Consumers filed a Motion before the Commission seeking a stay of orders in light of the changed circumstances, namely, the grant of certiorari by the Supreme Court. The Appeal Board has denied Consumers' Motion, thereby again reaffirming that this Licensing Board must reach a decision on the issues before it. See Consumers Power Company (Midland Plant, Units 1 and 2), ALAB-395 NRCI-77/___, ___ (April 29, 1977).

2/ The NRC Staff's Brief is being filed contemporaneously with its Proposed Findings of Facts and Conclusions of Law.

3/ Consumers power Company (Midland Plant, Units 1 and 2), ALAB-396, NRCI-77/___, ___ (May 4, 1977).

10. Regarding the issue of a clarified ACRS letter, the Board returned the original ACRS report, which was the subject of the Aeschliman decision, to the ACRS by its letter of October 14, 1976. In response to the Board's letter, the ACRS issued a "Supplemental Report on Midland Plant, Units 1 and 2" dated November 18, 1976. By letter dated January 28, 1977 to the ACRS, the Board raised three areas of comment on the November 18, 1976 response. In a March 16, 1977 letter to the Chairman of the Nuclear Regulatory Commission, the ACRS responded to these further requests of the Licensing Board.

11. The Commission has delegated its authority to act in the Midland proceeding to the Atomic Safety and Licensing Appeal Board, pursuant to 10 C.F.R. §2.785. This action was required as two Commission seats were then vacant and one of the three incumbents considered himself disqualified in this proceeding. In these circumstances, a quorum was not possible.[1/] For all purposes, the Appeal Board is acting as the Commission in this proceeding.

12. The Staff has issued draft and final supplements to the original environmental statement regarding the Midland Plant. The "Final Supplement to the Final Environmental Statement related to construction of Midland Plant Units 1 and 2" issued in June, 1977.

1/ Consumers Power Company (Midland Plant, Units 1 and 2), CLI-77-7, NRCI-77/___, ___ (March 18, 1977), and CLI-77-12, NRCI-77/___, ___ (April 5, 1977).

II. FINDINGS OF FACT

A. Adverse Environmental Impacts

13. Consumers has determined that the environmental impacts of construction activity at the Midland Plant from December 1, 1976 through September 1, 1977 will be minimal or non-existant. (Wells Testimony, p. 1).[1/] This is due to the fact that most significant construction impacts have already taken place. Site photographs indicated that general preparation of the site is nearly complete as is site excavation for major construction activities. (Wells Testimony, p. 2; Consumers' Exhibits Nos. 1-3).

14. Environmental impacts to be anticipated during the period December 1, 1976 to September 1, 1977 are noise, dust and fumes associated with concrete placement activities (Wells testimony, p. 5) and noise, dust, vehicle fumes, soil erosion, and siltation associated with earthwork operations (Wells testimony, p. 6).

1/ The Wells testimony follows Tr. 2946.

15. Consumers has a planned program to reduce these impacts to an insignificant offsite quantity through proper operation and maintenance of equipment and the use of good construction practices in the case of noise, fumes, and dust and through mulching, seeding and fertilizing appropriate areas in the case of soil erosion and siltation. (Wells testimony, pp. 5-6).

16. The impacts of dust, noise and fumes associated with traffic congestion are projected to increase during 1977 due to an escalation in the work force. This incremental increase, however, is minimized by the fact that industrial traffic is common to the area with two local employers having over 14,000 employees alone. (Wells testimony, p. 10).

17. Consumers has concluded that, due to the advanced state of construction, the efforts to mitigate adverse impacts associated with continued construction, and the basically industrial environment which surrounds the Midland Plant site, that any adverse environmental impacts associated with continued construction are minimal. (Wells testimony, pp. 12-13).

18. The Staff has determined that although the Midland Plant construction is less than 20% complete, virtually all impacts upon the environment due to construction have occurred. (Echols testimony, p. 1).[1/] Construction

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1/ The Echols testimony follows Tr. 3059.

activity during 1977 will be in the immediate area of the reactor complex where land has already been completely altered and control procedures are employed. Such activity includes concrete placement and earthwork and the environmental impacts due to such construction are normal traffic and noise associated with the project. (Echols testimony, pp. 1-2).

19. Although Mr. Wells examined in his testimony only the environmental impacts associated with a potential suspension period running from December 1976 to September 1977, Mr. Wells testified that the environmental impacts associated with construction of the facility beyond September 1977 would also be minimal. (Wells, Tr. 2966-2970. The Midland Plant is at the point where the remaining construction activity which will occur will have minimal impact. With regard to offside impacts, some transmission capability will have to be constructed but these transmission facilities are not extensive. Only about 1.2 miles of transmission line directly relate to the project. (Wells, Tr. 2983). These transmission facilities will be constructed some considerable time after September 1977. (Wells, Tr. 2984). The Staff also reached the conclusion that virtually all impacts upon the environment due to construction have already occurred. (Echols testimony, p. 1).

20. The Board finds that the majority of environmental impacts associated with the Midland Plant have already been incurred due to the advanced state of the construction project. Environmental impacts which will occur during the remainder of 1977 if construction were to continue are impacts associated with traffic such as noise, dust and fumes, and impacts associated with earthenwork such as siltation and eroision. The Board further finds that Consumers has undertaken mitigative procedures to reduce these impacts to an acceptable level. The adverse impacts associated with continued construction at the Midland Plant during 1977 are not environmentally significant.

B. Need for the Project

1. Need for Electricity

21. Consumers presented testimony identifying a need for the Midland Plant as currently scheduled. Consumers' capacity planning begins with a long-term forecast of electric sales. Consumers is currently projecting sales increases of 3.5% for 1977, and an average compound rate of growth of electricity sales of 5.2% for the period beyond 1977 through 1986. (Heins testimony, p. 2).[1/] The 5.2% growth rate was based upon the recommendations of Consumers' Energy Forecast Executive Review Committee. (EFERC). (Board Exhibit No. 4, p. 1.1-17).

22. The EFERC employed a probability encoding technique. The EFERC was provided with varied input concerning historical trends in electric sales, the causes of these trends and predictions of factors which could affect future sales. (Mosely, Tr. 3389-90). Energy conservation experience and expectations were specifically examined. (Heins testimony, p. 6).

[1/] "Testimony of Gordon Heins" follows Tr. 1648.

23. The 5.2% annual growth rate developed by the EFERC was confirmed by an independent study using Consumers more traditional analysis by class of customer. (Board Exhibit No. 4, p. 1.1-17). Future sales to each class of service (residential, commercial, industrial and others) were separately assessed. (Heins testimony, pp. 2-4). This traditional methodology included evaluation of historical data and assessment of trends for conservation, including price elasticity, more efficient use of appliances, more efficient types of appliances (Heins testimony, pp. 3-6) and insulation (Bickel, Tr. 2014).

24. The Staff examined the Consumers' forecast as well as that for Detroit Edison. Consumers and Detroit Edison comprise the Michigan Electric Coordinated System (MECS) and jointly service approximately 90% of Michigan's electrical needs. They constitute a highly integrated system and, in addition to joint planning efforts, they actively coordinate their transmission and generating equipment to meet the electrical needs of Michigan's lower peninsula. Because Consumers is an integral part of this large system, the Staff concluded that need for the Midland Plant must be viewed in the context of the combined capacity and combined demands of both Detroit Edison and Consumers. (Feld testimony, p. 2).

25. The growth rates for both Consumers and Detroit Edison took into account conservation as well as other inhibiting factors on growth. (Feld testimony, p. 4).

26. The Staff has also reviewed two independent analyses that projected growth in electricity demand on the MECS. (Feld testimony, p. 9). The Staff examined a 1974 Michigan Public Service Commission (MPSC) report entitled "Evaluation of the Consumers Power and Detroit Edison 1974 Load Growth Forecasts." That report concluded that the forecasting methodologies used by both Consumers and Detroit Edison appeared reasonable and consistent with generally accepted approaches used by the utilities across the nation. The report also concluded that the Consumers and Detroit Edison forecasts underestimated future peak demand. (Feld testimony, p. 10).

27. The independent forecast by the Michigan Governor's Advisory Commission on Electric Power Alternatives (GACEPA) was based on an econometric model which included a regression analysis by major customer class. (Feld testimony, p. 15). This forecast is in good agreement with the results of both Consumers and Detroit Edison's forecasts. (Feld testimony, p. 18).

28. The Staff has also examined a comprehensive econometric model concerned with future energy growth developed by the Federal Energy Administration. The model reports electric energy projections by region. The East North Central Region encompasses Michigan, and the forecasted growth rate for this region was examined and compared to the projections of Consumers and Detroit Edison. (Feld testimony, pp. 19-20). Consumers' forecast understated peak demand in 1982 by 360 MWe and Detroit Edison overstated growth by approximately 240 MWe. More importantly, MECS peak demand was understated on the part of the companies by about 100 MWe. (Feld testimony, p. 23).

29. The Staff has examined whether or not these forecasts give adequate weight to future conservation savings. (Feld testimony, p. 23). Consumers is actively involved in promoting conservation measures among its customers. Consumers has included conservations responses in its latest forecast. (Feld testimony, p. 25). The conclusion of the MPSC report was that both Consumers and Detroit Edison had factored conservation into their forecasts and that they did so in such a way as to overstate its likely impact on future growth. (Feld testimony, p. 25). The Staff concluded that Consumers and Detroit Edison adequately accounted for conservation in their present forecasts. (Feld testimony, p. 28).

30. The Staff has examined the results of an econometric forecasting model developed specifically for the NRC Staff by the Oak Ridge National Laboratory which is capable of forecasting electricity sales by state.[1/] The forecasting results for the State of Michigan were examined by the Staff. The Staff determined that the growth rate being forecast by the model for the State of Michigan for the period of 1975 to 1990 was slightly higher than the growth rate being forecasted by MECS. (Feld rebuttal, p. 5). The Board finds these results significant since the MECS constitutes approximately 90% of all electricity sales in Michigan.

31. Invervenors' witness presented testimony attempting to demonstrate that Consumers' forecast was inadequate for decision making. (Timm testimony pp. 44-65).[2/] Dr. Timm's conclusion was that the projected load growth of Consumers was most likely too high. Dr. Timm additionally identified a number of reasons which, in his opinion, render the Consumers forecast inadequate for decision-making purposes. Dr. Timm noted deficiencies in the projections of domestic average use (Timm testimony, p. 46), residential electric customer gains, commercial

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1/ "NRC Staff's Rebuttal Testimony of Sidney E. Feld on Forecast Methodology and Alternative Rate Designs" is found in the Special Transcript Volume of March 23, 1977.

2/ "Testimony of Richard J. Timm on Behalf of All Intervenors Except Dow Chemical Company" is found in the Special Transcript Volume of March 23, 1977.

32. electric sales, GM accounts, small accounts category and "other major" customers. (Timm testimony, pp. 49-50). Dr. Timm also identified deficiencies in the probability encoding methodology employed by Consumers. (Timm testimony, pp. 50(a)-50(c)). Finally, Dr. Timm identified inadequacies in the verifying study performed by Consumers to confirm the results of the probability encoding forecast. (Timm testimony, pp. 51-59).

33. The Board has examined the conflicting testimony on load forecasting. The Board concludes that the Consumers' forecast is the appropriate forecast to be employed for consideration of whether or not the Midland Plant is needed for commercial operation as presently scheduled. The Staff has independently reviewed the energy requirements of MECS and found them to be reasonable and consistent with projections of an econometric model developed for the Staff by the Oak Ridge National Laboratory.

34. Furthermore, the Board finds that the Consumer's forecast has been independently examined by both the Michigan Public Service Commission and the Michigan Governors Advisory Commission on Electric Power Alternatives. These analyses demonstrated that the Consumers' forecast was conservative. Furthermore, Consumers' forecast is consistent with energy projections of the Federal Energy Administration. The Board also finds that conservation has been adequately addressed in these forecasts.

35. The Board further finds that these forecasts may tend to underestimate electric demand because of the potential for increased growth in electrical consumption due to substitution of electrical energy for oil and natural gas. (Feld testimony, pp. 29-35; Gundersen testimony, p. 5).[1/] Substitution may result from shortages of supply and higher prices of alternate fuels. (Feld testimony, pp. 16-17; 29-35). The Board finds that substitution may constitute a potential source of increased demand in the MECS service area.

36. Once sales are forecast, the amount of generating capacity that will be needed to supply these customer needs must be determined. The Staff examined the capability data for the MECS presented in Board Exhibit No. 4, Tables 1.1-6 and 1.1-7. (Feld testimony, p. 5).

The Staff reviwed the data presented in these tables and modified it. The Staff assumed that the Palisades Plant would not be derated for steam generator tube degradation nor an outage required for repairs. This was based on the Staff's view of the uncertain nature of the derating or the outage.[2/] The Staff considered only capacity sales of Luddington to Consolidated Edison and of Fermi 2 to municipalities.

1/ "Testimony of Walter J. Gundersen" follows Tr. 5101.

2/ See Paragraphs 96 to 97 , infra.

Capacity sales associated with the Midland Plant and Campbell Unit No. 3 were not considered. Finally, the Staff has taken account of derating of capacity for both Consumers and Detroit Edison during the summer peak due higher cooling medium temperatures. (Feld testimony, p. 5).

37. After determining that the net capabilities of Consumers and Detroit Edison, with appropriate adjustments identified in the paragraph above, were reasonable, the Staff analyzed the need on the MECS system for additional capacity. The results of this analysis are presented in Table 1 of the Feld testimony. In the event Midland is not delayed, the reserve margin, which is defined as net capability as a percentage of peak demand, is projected to be approximately 20% from 1981 to 1983. However, with a one year delay in commercial operation of the Midland Plant, the reserve margin falls to 14.2% in 1981 to 18.1% in 1982. (Feld testimony, p. 4). Similar reserve margins in the event of a one year delay were presented by Consumers. (Heins testimony, pp. 10-11).

38. Generating capability must be planned to reliability serve the projected electrical demand. This requires excess capacity which is characterized by the reserve margin. (Gundersen testimony, p. 3)[1/] The design reliability goal to be used to determine the amount of installed

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1/ "Testimony of Walter J. Gunderson" follows Tr. 5101.

reserve required on an electrical system results from a loss of load probability (LOLP) analysis. The LOLP standard refers to the probability that the system, including installed generation and outside support, will not be able to serve its customer demand during a given period, requiring measures to prevent system collapse. (Gundersen testimony pp. 2-3).

39. Testimony was presented at the hearing by experts for the NRC Staff, the Federal Power Commission (FPC) and Consumers that the LOLP standard of one day in ten years is the recognized standard throughout the utility industry. (Feld testimony, p. 4; Gundersen testimony, p. 5; Heins, Tr. 1659; Ringlee testimony, p. 8).[1/] Intervenors' witness sought to show that a design reliability of goal of less than one day in ten years would preclude the need for additional baseload generating capacity. (Timm testimony, pp. 41-42). However, Dr. Timm also testified that his home state of Oregon used a more conservative reliability criterion of one day in twenty years and that he knew of no utility, or regulatory agency that employed or designed for a loss of load probability criterion of five days in ten years that he advocated. (Timm, Tr. 5949).

1/ "Direct Testimony of Dr. Robert J. Ringlee" follows Tr. 4801.

40. The Board finds that a loss of load probability (LOLP) of one day in ten years is the recognized standard throughout the utility industry and is the appropriate standard to be employed in determining the need for additional electrical generating capacity.

41. Experts for the Staff, the FPC and Consumers also testified that a reserve margin of about 20% is needed on the MECS to provide reliable electrical service. (Feld testimony, p. 4; Heins testimony, p. 9; Gundersen testimony, p. 6; Ringlee testimony, p. 10). Even with a 20% reserve margin, MECS will not meet the LOLP standard of one day in ten years. A 20% reserve margin is the minimal objective for MECS and Consumers. (Gundersen testimony, p. 6; Ringlee testimony, p. 10; Ringlee affidavit dated May 19, 1977, p. 11).

42. The 20% reserve margin required by MECS is contingent upon the availability of emergency energy from the other members of the East Central Area Reliability Coordination Agreement (ECAR). (Gundersen rebuttal, p. 4; Ringlee affidavit, pp. 12-13).[1/]

ECAR reserve margins are projected to be 24.34% for the summer of 1981, 25.8% for the summer of 1982, and 26.24% for the summer of 1983. Thus, the LOLP for the member systems of ECAR is within the acceptable range of about one day in ten years. (Gundersen affidavit,

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1/ "NRC Staff Rebuttal Testimony of Walter J. Gundersen on the Subject of Loss of Load Probability and Reserve Margins" contained in the Special Transcript Volume of March 23, 1977.

p. 4; "Affidavit of Gordon L. Heins on behalf of Consumers Power Company" dated May 19, 1977).[1/] However, without the Midland Plant, the MECS area of ECAR would be substantially deficient and dependent on other members of ECAR for emergency power supply. Therefore, the reliability of service to the customers of Consumers is contingent upon the accuracy of the load and capacity projections of those other member systems of ECAR. (Gundersen affidavit, p. 4).

43. The projected reserve margins for ECAR are based upon certain assumptions which could change significantly. The reserve margins assume the addition of three 1300 MWe coal-fired generating units by the American Electric Power Corporation in the summers of 1981, 1982, and 1983. Since the required construction permits have not yet been obtained, it is highly unlikely that such a large project could be implemented in time for its 1981 summer peak demands. Also financing for the project is questionable. (Gundersen affidavit, pp. 4-5; Ringlee affidavit, p. 13, Heins affidavit, p. 5). The ECAR reserve margins assume the full availability of the Palisades Plant. The Unit has experienced steam generator tube difficulties.[2/] A yearly derating of this unit is possible as is a major outage to repair the problem if dedregation continues. (Gundersen affidavit, p. 5; Ringlee affidavit,

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[1/] "Supplemental Testimony of Walter J. Gundersen" filed under affidavit dated April 20, 1977.

[2/] See paragraphs 96 to 97, infra.

p. 13). The ECAR reserve margins assume that present fossil units will have an assured fuel supply. Availability of oil and gas to supply fossil units beyond 1980 is uncertain. Consumers Karn-Weadock complex is dependent on imported Canadian oil and its continued use is subject to approval by the Canadian National Energy Board. (Gundersen affidavit, p. 6; Heins testimony, p. 11).

44. A traditional supplier of power and capacity to Consumers, Ontario Hydro, predicts deminishing reserve capacitities during the 1980's and has inquired as to the availability of firm power from Michigan. (Heins testimony, p. 13; Ringlee, Tr. 4804). Ontario Hydro has also indicated a reduction in the physical capability of its system to transfer power into the ECAR system during the 1980's. (Ringlee, Tr. 4804).

45. The Staff has also evaluated the need for baseload capacity on the Consumers' system. The analysis consisted of a quantative comparison of projected baseload demand and baseload capacity for the years 1981 through 1983. (Feld testimony, p. 5). The results of this analysis are presented in Table 2 of the Feld testimony. The analysis demonstrates that a one year delay of the Midland Plant will produce deficits in baseload capacity of 698 MWe in 1981 and 125 MWe in 1982.

46. Intervenors' witness testified that the Consumers' forecast incorrectly treated several items. Dr. Timm testified that Consumers had erroneously treated expected energy sales to Dow. (Timm testimony, pp. 23-26). Dr. Timm also testified that certain capacity sales of the Midland Plant and Campbell Unit No. 3 were incorrectly treated and that the Palisades Plant derating was likewise improperly treated. (Timm testimony, pp. 26-32). The Board recognizes the differences of the parties on each of these issues. The Board notes that, with regard to capacity sales and the Palisades Plant outage, the Staff treated both of these areas conservatively.[1/] With regard to the treatment of the Dow purchases, even if one assumes reductions in Dow demand are justified, the Board finds Dr. Timm has significantly overstated their magnitude. First, he relied on estimates of Dow's purchases that were higher than those embedded in Consumers' own energy forecast and consequently the reductions taken overstate that portion of Dow's demand tied to Midland. And second, Dr. Timm used average load and average efficiency values to derive peak load estimates. These parameters produce higher reductions than would occur had values characteristic of the Dow load been used. Ignoring these computational problems, the Board finds that even totally accepting Dr. Timm's position, the resulting improvement on system reliability and corresponding reduction in replacement power costs would not be sufficient to alter the Board's findings on these issues. The reductions under consideration

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[1/] See Paragraph , infra.

depending on the delay or cancel scenarios used, are approximately 10 to 20% of the Midland Plant's total capacity available for electrical generation. Since need has been demonstrated for over 1300 MWe, the Board finds that reductions of this magnitude are simply not large enough to offset this need. Furthermore, since replacement power costs are a function of the cost of providing the electricity that would be forthcoming from Midland had it been in operation, the effect of these reductions would be to lower these costs by a maximum of approximately 10 to 20% for any given year. Consequently, the bulk of the replacement power cost would remain in tact.

47. The Board also recognizes the differences of the parties regarding the proper reserve margin to meet the LOLP standard of one day in ten years. Dr. Timm's analysis was the subject of considerable rebuttal and cross-examination and the Board views that analysis as questionable. The Board was impressed with the quality of the analyses performed by the experts for the Staff, the FPC and Consumers and finds that a 20% reserve margin is the minimum needed to supply reliable electric service on the MECS system. This reserve margin is needed in view of the inability of Ontario Hydro to supply power to MECS in the 1980's and numerous uncertainties as to the ability of ECAR to supply power in this period. A delay of the Midland Plant

would make the 20% reserve margin unobtainable. The need for the Midland Plant is further confirmed by the Staff's baseload analysis. The Board finds a need for the Midland Plant as presently scheduled.

2. Need for Steam

48. Dow presented testimony identifying its need for process steam at its Midland facilities. (Temple testimony).[1/] Dow is currently producing all of its steam and some of its electricity for its Midland facilities from its own fossil-fired units. Dow has determined that these units must be replaced as soon as possible, as the facilities are old and cannot be made to operate safely and reliably beyond 1984. (Temple testimony, pp. 3-5; Tr. 2669-71; Orrefice, Tr. 2733.)

49. A second reason motivating Dow to replace its present process steam generating facilities is concern with state and federal air quality requirements. Dow's facilities are currently being operated under a consent order with the Michigan Air Pollution Control Commission (MAPCC) which permits continued operation until July, 1980. Operation beyond 1980 will require a further consent order from the MAPCC. (Temple testimony, p. 4). Dow and the MAPCC Staff have reached an agreement

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1/ "Testimony of Joseph G. Templer, Jr." follows Tr. 220.

on a Proposed Resolution and a Stipulation for Entry of Consent Order and Final Order which would permit continued operation of Dow's fossil facilities beyond July, 1980. ("Supplemental Responses to Interrogatories" dated March 29, 1977; Response 1.K.). The Consent Order is now before the MAPCC for its consideration.

50. Dow is also subject to the regulatory jurisdiction of the U.S. Environmental Protection Agency (EPA) with regard to air quality standards. EPA served a "Notice of Violation" upon Dow on November 18, 1976. (Temple, Tr. 2535). EPA action could possibly shut down the Dow facilities. (Temple, Tr. 2544). The position of EPA is presented in Exhibit B attached to Reponse 1.k. of "Dow's Further Responses to Interrogatories" dated February 28, 1977. It is EPA's position that Dow's facilities do not comply with the Michigan State Implementation Plan and that Dow must take steps to comply with that plan. (Exhibit B, pp. 1-4). Dow seeks to replace these units as soon as possible due to problems associated with meeting state and federal air pollution control requirements. (Temple testimony, p. 5). (Orrefice, Tr. 2709; 2733).

51. The Board finds that Dow has a need for a new source of process steam to replace its present facilities and that this new source is required no later than the end of 1984.

52. On January 30, 1974, Dow and Consumers entered into a "Contract for Steam Service" (Consumers' Exhibit No. 7c attached to the testimony of Howell).[1/] Under that contract, Consumers is to provide Dow with large quantities of process steam from its Midland Plant. Dow is to purchase process steam from Consumers in amounts ranging from the contractual minimum requirement of 2 million lb/hr of 175 psig steam to the current maximum reserved capacities of 2,400,000 lb/hr of 175 psig steam and 400,000 lb/hr of 600 psig steam. (Temple testimony, p. 8). The contract calls for the supply of steam by Consumers to Dow upon commercial operation of the Midland Plant which date was estimated to be March 1, 1980. (Consumers' Exhibit No. 7c, p. 4; Temple, Tr. 310; Howell, Tr. 2090). The contract provides no explicit date for the commencement of the delivery of steam to Dow by Consumers.

53. Negotiations have been taking place between Dow and Consumers with the objective of modifying the present steam contract. (Howell Testimony, p. 7; Temple testimony, pp. 6-8). These negotiations effect a number of contract provisions with both parties seeking modifications to reflect changing circumstances.

[1/] "Testimony of Stephen H. Howell" follows Tr. 2074.

54. Since May, 1974, Dow has continuously reviewed its commitment to take process steam from the Midland Plant. These reviews were prompted by construction delays and cost increases associated with the Midland Plant. The latest review of the Dow commitment to utilize process steam from the Midland Plant occurred in September, 1976. At that time, the Michigan Division of Dow Chemical U.S.A. concluded that the Midland Plant was no longer advantageous to Dow. (Board Exhibit No. 1, p. 3; Temple, Tr. 387.) As a result of this conclusion reached by the Michigan Division, Mr. Orrefice ordered that a corporate review take place to examine this division decision and to determine whether or not it should be adopted by Dow Chemical U.S.A. as the Dow corporate position.[1/] (Board Exhibit No. 1, p. 3; Board Exhibit No. 2; Temple, Tr. 424). The coporate review was conducted on September 27, 1976 by Mr. Orrefice and the Dow U.S.A. Operating Board. (Temple, Tr. 425).

55. The corporate review examined Dow's commitment to the Midland Plant from a number of perspectives. An individual was assigned to each item to conduct the review and present an evaluation. (Board Exhibit No. 2). A major item was economics.

1/ The Dow corporate position as used in the Staff's findings refers to the decision on the part of the Dow U.S.A. Operating Board rather than the Dow Chemical Company's corporate board. Dow U.S.A. is the entity within the Dow Chemical Company which has jurisdiction over and makes final decisions related to the Dow Michigan Division. (Orrefice, Tr. 2717). The Dow corporate position with regard to the review of the Michigan Division decision was delegated by the Dow Chemical Company to Dow U.S.A. (Temple, Tr. 429).

56. In examining the Midland Plant to other alternatives for process steam, Dow concluded that the Midland Plant retained a cost advantage although the difference in cost between the Midland Plant and a coal-fired alternative had narrowed appreicably. (Temple, p. 5; Orrefice, Tr. 2699).

57. In conducting its corporate review, Dow utilized nuclear fuel cost data supplied by Consumers. (Temple, Tr. 2553-54). This data has changed substantially since the corporate review was conducted in September, 1976. The increased nuclear fuel costs for the Midland Plant wer presented in the revised Keeley testimony[1/] and reviewed by the Staff.[2/] It is uncertain whether Dow would again conclude that the Midland Plant is economically preferred if the revised nuclear fuel cost data were used.

58. One of the factors which played a role in developing the Dow corporate position was the possibility of litigation if Dow failed to continue to support the Midland Plant. The question regarding litigation was raised by Mr. Aymond, Chairman of the Board of Consumers and Chief Executive Officer, at a meeting between Dow and Consumers on September 24, 1976. (Orrefice, Tr. 2694-2696). (Temple, Tr. 2558).

1/ This Keeley testimony follows Tr. 3646

2/ "NRC Staff Supplemental Direct Testimony of Jack Roberts - Nuclear Fuel Costs Analysis" follows Tr. 5099.

59. The specific nature of the litigation question relates to Article 3 of the "General Agreement between Consumers Power Company and the Dow Chemical Company" dated December 13, 1967 (Staff Exhibit No. 4). Under Article 3,[1/] Dow must provide licensing support to Consumers relating to the construction and operation of the Midland Plant. (Temple, Tr. 433). Failure on the part of Dow to meet its obligations under this Article could enable Consumers to seek appropriate relief through court action.

60. Mr. Orrefice testified that the possibility of litigation was a very important factor in forming the ultimate Dow corporate conclusion to continue to support the Midland Plant. (Orrefice, Tr. 2699). The Board finds that one of the risks associated with doing business is a risk of litigation. A reasonable factor for Consumers to raise and to bring to the attention of Dow was the possibility of litigation should Dow reach a decision adverse to Consumers and the possibility of litigation is a reasonable consideration to be included in the formulation of Dow's corporate position.

61. The result of the corporate review of September 1976 was a continued commitment by Dow to the Midland Plant given a startup date for Unit No. 2 of early 1982 and given a plant cost at 1.67 billion dollars. (Temple testimony, p. 2). This commitment was reaffirmed by Mr. Paul F. Orrefice, President of Dow Chemical, U.S.A., member of the

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1/ Article 3 was read into the record at Tr. 2563-2564.

Board of Directors of the Dow Chemical Company. Mr. Orrefice testified before the Board on February 2, 1977 that the Dow corporate position continues to be a commitment to purchase process steam from the Midland Nuclear Plant. (Tr. 2690). Mr. Orrefice indicated on February 2, 1977, that he had no information relating to startup date or construction costs which could cause the corporate decision reached in September of 1976 to be altered. (Tr. 2690).

62. Mr. Orrefice further testified that as part of the corporate position reached in September 1976, Dow intended to keep their options open and to continuously review their commitment to take process steam from the Midland Plant. Such an approach, in the view of Mr. Orrefice is ordinary and prudent business practice. (Tr. 2693). Should circumstances change significantly, Dow might change its position and reach a different conclusion. (Tr. 2693). But as of the date of his testimony, and following a recent corporate review, Mr. Orrefice stated the Dow corporate position to be an intent to purchase process steam from the Midland Plant. (Tr. 2690).

63. The Board recognizes that Dow has expressed concerns with regard to its commitment to the Midland Plant. Dow is concerned with Consumers' ability to operate the plant, based upon Dow's perception of poor performance by Consumers . (Temple, Tr. 2418; 2424-26; Orrefice, Tr. 2709). Dow is concerned with the regulatory environment and specifically the jurisdiction of the Michigan Public Service Commission over stream and electricity to be produced from the Midland Plant. (Temple, Tr. 2418). Dow is concerned with the costs and availability of nuclear fuel. (Temple, Tr. 2419-22). However, Dow's principal concerns relate to plant cost (Orrefice, Tr. 2709; Temple Tr. 2301), and plant schedule (Orrefice, Tr. 2709; Tr. 2711-2712; Temple, Tr. 2300).

64. Dow's commitment to the Midland Plant is based, in part, on its economic advantage.[1/] Increases in the cost of the Midland Plant could affect that advantage.

65. The presently projected cost of the Midland Plant is 1.67 billion dollars. (Keeley testimony, p. I-8).[2/] Bechtel, the architect-engineer for the Midland Plant, periodically updates budget and schedule data and

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1/ See Paragraph Nos. 55 to 57, infra.

2/ This Keeley testimony follows Tr. 602.

provides new estimates. The most recent Bechtel forecast is Forecast #2 (Consumers' Exhibit No. 30). These estimates are then reviewed by Consumers and final costs and schedules are developed. (Howell, Tr. 2792-95).

67. Consumers has completed its examination of the Bechtel Forecast #2. ("Affidavit of Steven H. Howell on behalf of Consumers Power Company," dated May 18, 1977). Consumers' review is summarized in an April 6, 1977 memorandum from Howell to Selby, which is attached to the Howell affidavit. That memorandum recommends that the current budget forecast of $1.67 billion be retained. Both Bechtel and the Consumers' review team identified cost increases associated with the project. The final Consumers' review presented to Mr. Howell identified a total increase in project cost of approximately 5%. Mr. Howell agreed with the recommendations of the Consumers' review team but concluded that the present cost estimates should not be altered at this time. Pointing out that present indications are that the projected cash expenditures for 1977 may be too low by $25 to $30 million, nevertheless, Mr. Howell wished to reserve decision on a

budget revision for approximately 6-9 months to obtain a better analysis of construction progress. (Howell memorandum, p. 2). This recommendation was adopted by the Executive Committee of the Board of Directors of Consumers on March 28, 1977. (Howell affidavit, p. 2).

68. Consumers directed Bechtel to prepare an upper bound estimate to serve as a measure of how high the cost of the Midland Plant could go. (Howell, Tr. 2808). Bechtel generated a 1.5 billion dollar figure to which Consumers added its overheads to develop the two billion dollar figure. This figure is imprecise and is not a formal estimate. (Howell, Tr. 2809; Keeley, Tr. 3880-81).

69. The present schedule for the Midland Plant calls for commercial operation in March, 1981 and March, 1982 for Units 2 and 1, respectively. (Keeley testimony, p. III-1).[1/] These dates were established in the early part of 1975. (Keeley, Tr. 3690). In Forecast #2, Bechtel examined these dates and identified a probable schedule slip of 5 months. The Consumers' review team concluded that the present schedule could be met, noting that the potential for a schedule slip does exist, but cannot be precisely identified at this time. (Howell

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1/ This Keeley testimony follows Tr. 3638.

memorandum, p. 2). This recommendation was also adopted by the Executive Committee of the Board of Directors of Consumers on March 28, 1977. (Howell affidavit, p. 2).

70. With regard to the five-month slippage identified in Bechtel in Forecast #2, Consumers testified that the chances are 50/50 that the five-month slip will occur. Consumers presented conflicting testimony as to the possibility of recovering from a five-month slippage in schedule. While Consumers testified that additional expenditures for manpower could reduce the probability of a five-month slip (Keeley, Tr. 3697) and the present schedule could be compressed in the areas of plant startup and preoperational testing to allow for the makeup of approximately four to five months of lost time (Keeley, Tr. 3694), Consumers also testified that a five-month delay in construction could not be made up at a later date through accelerated construction and overtime. (Keeley, Tr. 1129-1130).

71. Although Consumers has had labor strikes on the Midland site in the past, there has been no allowance for labor strikes in the present schedule. (Keeley, Tr. 3708). This is true even though Consumers would expect strikes to occur prior to the completion of the project. (Keeley, Tr. 3709).

72. Consumers testified as to the likelihood of construction on the Midland Plant extending to the end of 1984. The possibility of the Midland Units not being in commercial operation by the end of 1984 was considered

to be very unlikely. (Keeley, Tr. 3721). In addition, a narrow band of from four to six months uncertainty was associated with the commercial operation date of the Units. (Keeley, Tr. 3722).

73. At the hearing, the question of the impact of compliance with regulatory requirements on plant cost and schedule was raised. Consumers has undertaken an examination of the impact of such compliance on plant schedule and cost. (Keeley, Tr. 1077; 1078; 1394; 1421-42). Consumers has examined the impact on plant costs and schedule of generic ACRS items. (Consumers' Exhibit No. 32). In its Exhibits S-6, S-6A, S-6B, S-6C, S-6D and S-6E, Consumers examines the impacts of various ACRS items. Consumers did not limit the anlysis to items included in the November 18, 1976 letter. For each of the items identified, the Exhibits indicate that Consumers has included an estimate of the cost of resolution in its current estimate of 1.67 billion dollars. The Exhibits also examine the potential effect on plant schedule of resolution of the various ACRS items and identified 3 areas of potential impact. These are potential schedule extensions due to certain quality assurance requirements (S-6C, p. 1), potential modification of coolant pumps overspeed features (S-6D), and potential modifications with regard to fire protection and vessel support structures (S-6F).

74. Consumers testified that the potential schedule delay in the quality assurance area is approximately 3 months. (Keeley, Tr. 3716). With regard to the other items identified as having potential schedule impacts, Consumers could not quantify those impacts as the nature of the modifications, if any, are unknown. (Keeley, Tr. 3717-3718).

75. Consumers requested that the Staff review the compliance of the Midland Plant with Regulatory Guides and that review is currently complete up through Regulatory Guide 1.75. Consumers has evaluated the impact of compliance with those guides upon its construction schedule and has explicitly factored the cost and schedule impacts into the budget estimate of 1.67 billion dollars and the commercial operating dates of March, 1981 and March 1982. (Keeley, Tr. 3709-3711).

76. The remaining Regulatory Guides for which the Staff review is not yet complete were included in the development of Consumers Exhibit No. 32. (Keeley, Tr. 3711-12). Consumers performed an engineering review of the items identified, taking into account applicable regulatory guides, codes, standards and ACRS meeting minute notes in an effort to identify a resolution and whether the cost and schedule impacts of such resolution were included in the forecast budget. (Keeley, Tr. 3714).

77. At the hearing, the question of the impact of financing the Midland Plant on schedule was raised. Consumers examined its ability to finance the Midland Plant under various senarios. The senarios are presented with varying rates of return on common equity. A 15% level has been requested by Consumers in its most recently filed rate case. A 13.5% level was recently authorized by the Michigan Public Service Commission to Indiana and Michigan Electric Company. A 12.75% level represents the level granted to Consumers approximately 1 year ago. (Boris testimony, p. 3)[1/] Excluding any credits for the sale of portions of the Midland Plant to certain electric cooperatives, and assuming that the accounting changes recently requested by Consumers in its rate filing of January 31, 1977 are not allowed, and that rate relief at the level of 12.75% is forthcoming from the Michigan Public Service Commission, Consumers concludes that a financing program to support the Midland Plant can be carried out. (Boris testimony, pp. 3-4; Consumers' Exhibit No. 37B, p. 5).

78. The Staff examined the ability of Consumers to finance construction of the Midland Plant.[2/] The Staff assessed Consumers' financial planning to determine whether its proposed construction program which includes the

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1/ "Testimony of Walter R. Boris" follows Tr. 4912.

2/ "NRC Staff Supplemental Testimony of Arnold H. Meltz on Applicant's Ability to Finance Construction of the Midland Plant" follows Tr. 5665.

Midland Plant appears obtainable. (Meltz testimony, p. 3). The Staff determined that Consumers' recent financial history indicates a substantial improvement in its financial position since 1974. The estimated 12.6% return on common equity achieved in 1976 is significantly better than the average industry performance in that year. (Meltz testimony, pp. 3-4). The Staff concluded that in the event the entire Consumers' construction program could not be financed, there are still options available to finance the Midland Plant, such as selling additional securities or increasing the Midland Plant's priority since it only represents about 40% of the total construction budget. (Meltz testimony, pp. 6-7). The Staff examined the information supplied by Consumers as attachments to the Boris testimony, specifically Consumers' Exhibit No. 37B and determined that those assumptions were reasonable. (Meltz, Tr. 5071). The Staff concluded that under current reasonable projections of what the future is likely to be, both in the capital markets, and in regulation in the State of Michigan, the Midland Plant can be financed by Consumers. (Meltz testimony, p. 7; Tr. 5086).

79. Based on the information presented to this Board, the Board finds that the capital cost estimate for the Midland Plant is reasonabley subject to change. The extent of the cost increase cannot be readily identified. The Consumers' review of Forecast #2 indicates an increase

of 5% could be expected. However, an upper bound for a total projected cost of the Midland Plant of 2 billion dollars appears conservative. The Board finds that the projected costs of the Midland Plant could range between 1.67 billion and 2 billion dollars with the most likely cost being in the lower end of the range.

80. With regard to schedule, the Board finds that the presently estimated commercial operation dates for the Midland Plant are reasonably subject to change. The Board recognizes the relationship between costs and schedule and that schedule impacts can be minimized by additions to the work force with resulting cost increases. Again, an upper range for completion of the Midland Plant has been identified as the end of 1984. The Board finds that the Midland Plant could be completed in the period extending from March 1981 through the end of 1984 with the likely completion dates being in the lower range of that interval. The Board finds it extremely unlikely that the Midland Plant will not be complete by 1984.

81. At the hearing, the question of the impact of the negotiations between Dow and Consumers regarding changes to the current contracts was raised.[1/] Contract negotiations between Consumers and Dow have reached the position by January of 1977 that the two parties remain

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[1/] See Paragraph 53, supra.

far apart in efforts to seek renegotiated contracts. (Temple, Tr. 2297-2298; Howell, Tr. 2083-88; Orrefice, Tr. 2723-25, 2731, 2736). Items in dispute are Dow's insistance that it be provided with a firm contract termination date beyond which Dow would be relieved of its obligation to take steam from the Midland Plant and Consumers' insistence that Dow invest substantial money in the Midland Plant and agree to a force majeure clause relating to the final termination date. (Howell, Tr. 2084-2086).

82. With regard to Dow's commitment to take steam from the Midland Plant, the Board finds that the commitment is predicated upon current projections for plant cost and commercial operation dates. While both of these factors are reasonably subject to change, the record evidence supports a plant cost and commercial operation dates reasonably close to those presently projected by Consumers. The Board further finds that a number of other factors affect the Dow commitment, specifically the status of current contract negotiations, concern over Consumer's management ability, regulatory environment, nuclear fuel costs and financing ability. Nevertheless, the stated corporate position of Dow remains a commitment, if current cost and schedule projections do not change significantly, to utilize the process steam from the Midland Plant. Based on this commitment, the Board finds a present need for the process steam to be generated by the Midland Plant.

C. General Public Policy Concerns

83. Consumers has analyzed the effect of a delay in the commercial operation of the Midland Plant on the ratepayers of Consumers. ("Affidavit of James H. Climer on the Affect on the Ratepayer of a Delay in the Midland Project," dated May 1, 1977). That affidavit examines the effect of a Midland Plant delay on three classes of customers for both a five-month and a nine-month suspension period. (Climer affidavit, Attachments A and B). While the Board recognizes that the effect on the ratepayers of a delay in the commercial operation of the Midland Plant is a complex analysis requiring a number of simplifying assumptions, the Board nonetheless finds that the Consumers' ratepayers will probably be subject to increased bills directly related to an interm suspension of the Midland Plant .

84. Consumers has analyzed the effect of a delay in commercial operation of the Midland Plant on the investors of Consumers. ("Affidavit of Blake O. Fisher on the Effect of a Delay of the Midland Units on the Investors of Consumers Power Company," dated May 19, 1977). Consumers examined the time period 1976 through 1984 (Fisher Affidavit, p. 5). Consumers estimated that external financing over this period would have to increase by approximately 200 to 400 million dollars dpending on the extent of the delay. The need to raise this additional external capital would mean increased risk to all investors because additional investors would dilute the physical property available to investors. Earnings per share would be only moderately affected during the delay period. However in the years in which the Midland Plant would go into commercial operation, a severe impact is projected. Earnings per share are projected to be between $1.00 and $2.00 lower in 1982-83 again depending on the delay period involved. (Fisher affidavit, p. 6; Attachment E). In addition, a delay of the Midland Plant would impact on indenture coverage producing a reduction in protection provided to investors in Consumers' First Mortgage Bonds during the delay period. (Fisher affidavit, p. 7; Attachment E). While the Board recognizes that the effect on investors of a delay in the commercial operation of the Midland Plant is a complex analysis requiring certain simplyfing assumptions, the Board nonetheless finds that a suspension of the facility would produce a detrimental effect upon Consumers' investors.

85. Based on the established need for the electrical capacity of the Midland Plant,[1] delay or abandonment would result in increased fossil fuel usage both by Consumers and the utilities from which it would purchase replacement power (Heins Testimony, p. 16).[2] Estimates of the additional fossil fuels burned by Consumers are set out in Consumers' Exhibit No. 15, attached to the Heins testimony. Significant quantities of oil and natural gas would be used by Consumers to generate replacement power for the Midland Plant in the event that plant were either abandoned or delayed. The Board finds that, even if available, unnecessary depletion of fossil fules would not be in the public interest

86. Additional impacts have been identified with a suspension of construction in the Midland area. (Keeley testimony, p. III-9).[3] The Midland Chamber of Commerce has estimated that if only 1200 workers were laid off, a minimum expenditure of some 3 million dollars for unemployment compensation would be required during the 26 week eligibility period and the expenditure could be in excess of 4 million dollars. Such unemployment compensation would place a major economic burden on employers, unemployment compensation carriers and the state and federal government. (Keeley, p. III-10).

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[1] See Paragraphs to , infra.

[2] "Testimony of Gordon Heins" follows Tr. 1648

[3] This Keeley testimony follows Tr. 3638.

Suspension of construction would also produce a reduction in tax revenues for the city, county and state governments. Absent a corresponding increase in tax rate or property valuation, the number and quality of services provided by these governmental entities would decrease. (Keeley, pp. III-10; III-11).

Suspension of construction at the Midland Plant could provide a general disruptive force on the community. While it is difficult to quantify and identify the particular affects of such a disruptive force, a number of adverse effects on the community would be associated with the suspension of construction. (Keeley, pp. III-11; III-12).

The Board has considered impacts upon the ratepayers and investors of Consumers, additional depletion of oil and gas resources and the economic and social impacts of a suspension of plant construction. The Board finds that, based upon a consideration of these impacts, the public interest would be best served by continued plant construction.

D. Tilting the Cost-Benefit Balance

87. A number of alternatives were examined to determine which alternative generating souces should be analyzed for potentially tilting the cost-benefit balance. The feasibility of constructing a smaller nuclear plant at the Midland site as a substitute for the nuclear plant now under construction was examined. (Crocker testimony, p. 1).[1/] While a smaller nuclear unit could probably be obtained in the market place, a smaller unit is not a realistice alternative. Present utility and vendor efforts are concentrated on larger units in the range of 3,000 to 3,800 megawatts, thermal, and a time and cost penality would be incurred if a smaller plant was desired. As a smaller unit would have limited marketability, the entire cost of developing the design would be charged to the utility seeking that unit. As smaller units are not standard, additional time would be required for design and additional licensing effort would be required as the design would deviate from standard designs familiar to the NRC Staff. (Crocke. testimony, p. 2).

1/ "NRC Staff Testimony of Lawrence P. Crocker Relating to the Possibility of Constructing a Smaller Nuclear Plant at Midland" follows Tr. 4177.

88. The present Midland Plant is approximately 63% complete for engineering activity and 19% complete for construction activities. (Keeley testimony, p. I-2).[1] In addition the bulk of the nuclear plant components are now on order. Under these circumstances, even though a smaller plant might be available for purchase, such action does not represent a viable alternative. (Crocker testimony, p. 2-3).

89. In the event it should be determined that less power is needed from the Midland Plant than its present design capacity, and that therefore smaller units would suffice, the preferred course of action would be the continuation of present construction and the operation of the Midland Plant at whatever power levels are desired up to the rated capacity. Such continued construction would fully utilize already committed resources and would provide for ultimate expansion to meet increases in power needs. (Crocker Testimony, p. 3).

90. The Board has found that a need for the full output of the Midland Plant has been established in the timeframe of its presently projected commercial operation.[2]

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[1] This Keeley testimony follows Tr. 501.

[2] See Paragraphs through , infra.

Even in the event that the full output of the Midland Plant would not be required in the timeframe of presently projected commercial operation, halting construction of the present facility and changing to a design with a smaller output is not a realistic alternative. Cost and time penalities would be associated with such a change and the identical effect of such a change could be achieved by operating the present Midland Plant at a reduced power level. This latter approach has the advantage of using presently committed resources and also providing an additional amount of capacity which would be available for future use.

91. Consumers determined that, due to the limited availability of oil or gas to fuel a facility generating the quantities of electricity that the Midland Plant is designed to generate, and due to the long lead time on licensing and construction that would be required for a nuclear alternative to Midland at another site, a coal-fired facility was identified as the only feasible alternative to the Midland Plant. (Keeley testimony, p. IV-3).[1/] The earliest a nuclear plant could be developed at an alternate site would be 1985. (Keeley, Tr. 3684-3685).

1/ This Keeley testimony follows Tr. 3646.

92. The minimum time required to bring each of the two 800 megawatt electric coal units on line is 7 years, which results in an in-service date for these units of 1984. (Keeley testimony, p. IV-3). This estimate is based on Consumers' experience with its coal-fired Campbell Unit NO. 3. (Keeley, Tr. 3685).

93. Consumers considered the alternative of two 650 megawatt electric plants which would generate the equivalent electrical output as the Midland Plant plus a process steam boiler facility to supply the process steam requirements for Dow. The cost of that combined facility was found to be greater than the cost of two 800 megawatt units which led to the determination that the two 800 megawatt units offered the most reasonable alternative. (Keeley, Tr. 3686).

94. In examining alternatives to the Midland Plant, the interval of time between the date when the Midland Plant could have been generating electricity and the date when a replacement facility would begin generating electricity would require the generation of replacement power. The costs of replacement power by year for the years of 1981 through 1984 are presented in Consumers' Exhibit No. 14 and attached to the Heins testimony.[1/]

1/ The Heins testimony follows Tr. 1648. Also Consumers' Exhibit No. 14 was revised as of February 7, 1977.

95. This Exhibit indicates additional fuel and purchase power costs of 221 million dollars for a 9 month delay and 364 million dollars for a 15 month delay. These costs are the result of having to pay higher fuel and purchased power costs in a particular year when the low-cost Midland Plant is not in operation. (Heins testimony, p. 14). The costs presented in Consumers' Exhibit No. 14 assumed that the Palisades Plant was available for operation until the Midland Plant comes on-line. (Heins testimony, p. 15).

96. Consumers has identified a risk of continued deterioration of the steam generators at the Palisades Plant with the resultant reduction in its generating capacity. Due to steam generator tube degregation in the Palisades Plant, and due to existing uncertainties with regard to the continuation of such degregation, Consumers has determined that it would be prudent to plan for the plugging of tubes in the future and also to plan for the associated reduction in the capability of the unit. (Heins testimony, p. 10). Furthermore, due to the possibility of protracted outages and continual deratings, Consumers decided to study and plan for the repair or replacement of the existing steam generators which would be accomplished by a major outage. (Noble Testimony, pp. 12-13).[1/] The required outage would be on the order of 2-3 years. (Noble testimony, p. 14).

[1/] The Noble testimony follows Tr. 4754.

97. The Board finds that the future capability of the Palisades Plant is uncertain. While steam generator tube degregation has been identified as having the potential to reduce the capability of the Plant, continued degregation is uncertain. In addition, there are alternative proposals specifically, steam generator tube sleeving, which could nullify the need for any outage. (Heins, Tr. 1671). Furthermore, inspection of the steam generator tubes in the future may indicate no further deterioration. (Heins, Tr. 1671). To the extent that the assumption of continued deterioration of the Palisades Plant and an associated major outage for repairs leads to increased costs, of replacement power, such an approach is overly conservative.

98. In examining costs and benefits, Consumers considered the base case to be a continuation of the Midland Plant, with "to-go" capital costs based on the 1.67 billion dollar estimate. (Keeley testimony, p. IV-4). This figure was adjusted to account for salvage value of materials, requirements for site restoration and payments due from Dow in the event of abandonment. (Keeley testimony, pp. IV-1 to IV-3).

99. The results of the Consumers analysis are presented on Consumers' Exhibits Nos. 20-23.[1/] These Exhibits demonstrate that the high sulfur coal-fired units would be less expensive than the low sulfur

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1/ The Consumers' Exhibits Nos. 20-23 attached to the Keeley testimony were updated to account for minor changes due to the treatment of decommissioning costs. See "Affidavit of Gilbert S. Keeley on Behalf of Consumers Power Company" dated May 18, 1977.

coal-fired units. Furthermore, for each of the cases examined by Consumers, the costs associated with completing the Midland Plant are substantially less than the costs associated with the most economical alternative. (Consumers' Exhibit No. 21). Based on this analysis, Consumers reached the conclusion that continued construction of the Midland Plant would not tilt the cost-benefit balance away from the most reasonable alternative and would not affect the balance significantly. (Keeley testimony, p. IV-8).

100. The Board notes that Consumers employed nuclear fuel costs in its analysis which assumed the recycle of plutonium. (Keeley, Tr. 3783-86). The Board takes official notice that the recycle of plutonium has been rejected as a national energy objective. Furthermore, the Staff conducted a review of the nuclear fuel costs used by Consumers. Consumers' fuel costs were compared to the fuel cycle components developed in the "Final General Environmental Statement on the Use of Recycled Plutonium and Mixed Oxide Fuel in Lightwater Cooled Reactors" (GESMO). Low, reference, and high values were compared (Roberts testimony, p. 1).[1/] Based on this comparison, the Staff concluded that Consumers' nuclear fuel costs appeared high when compared to the high and reference values used in GESMO. (Roberts testimony, p. 6). Finally, the analysis made

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[1/] "NRC Staff Supplemental Direct Testimony of Jack Roberts - Nuclear Fuel Cost Analysis" follows Tr. 5099.

by Consumers assumed various abandonment dates which are no longer realistic. A realistic abandonment date would impact on the Midland Plant "to-go" costs as well as the costs associated with replacement power and the alternatives. In spite of these factors, the cost advantage for the Midland Plant is so great that the Board concludes a cost advantage would be maintained had the above factors been correctly treated.

101. The Board's conclusion is supported by the analysis of alternatives performed by the Staff.[1/] The Staff analyzed two 800 megawatt electric high-sulfur coal plants and two 800 megawatt electric low-sulfur coal plants. (Feld testimony, p. 2). For each alternative, cost components considered were capital, operation and maintenance, fuel, taxes, decommissioning, and insurance. In addition, for the coal alternatives, the Staff factored in the cost of replacement power. (Feld testimony, p. 1).

102. In calculating the cost of replacement power, the Staff assumed an in-service date for the coal alternative of Janury 1, 1984. As the Midland Units are presently scheduled to come on line on March 1, 1981 and March 1, 1982, abandonment of the Midland Plant would require the generation of replacement power for the period 1981-1983. (Feld testimony, pp. 6-7).

1/ "NRC Staff Testimony of Sidney E. Feld on Cost of Midland v. Coal Alternatives" following Tr. 4509.

In its calculations, the Staff has conservatively estimated that this replacement power can be made up internally with Consumers' generation while in actuality a portion would have to be purchased at greater cost to Consumers. (Feld testimony, pp. 1-2).

103. In addition as the Midland Plant is presently under construction, a portion of its capital cost is already sunk. For a proper analysis, the sunk cost of the facility, less the salvage value, should be added to the capital cost of alternatives as these costs would still be borne in the event that one of the alternatives is chosen. The Staff did not consider sunk costs in its analysis. This was identified by the Staff as an additional conservatism in its analysis. (Feld testimony, p. 1-2).

104. In examining the coal alternative, the Staff assumed that the cost of generating electricity and steam are essentially equal. No account was taken of the fact that for one of the 800 megawatt coal units, special process steam generating equipment would be required to supply the needs of Dow. The Staff determined that this assumption was conservative for the Staff could identify a specific 20 million dollar reduction in the cost of the coal alternative were it to supply process steam. The Staff did not reduce capital costs by this amount and, as there would be a number of potential increases in capital costs if the facility were to generate process steam, this approach is conservative. (Feld, Tr. 4548-49).

105. The results of the Staff's analysis are presented in Table 1 of the Feld testimony (p. 8). The low-sulfur coal alternative is shown as the most economic alternative to the Midland Plant with a 30-year levelized cost of 52.5 mills per kwh as compared to a 30-year levelized cost of the Midland Plant of 43.3 mills per kwh.

106. Dr. Feld amended Table 1 (at Tr. 4512-13) to identify the conservative assumptions involved in the analysis. These assumptions include the use of total capital costs rather than "to go" costs, escalation in the price of coal at the rate of 5% a year which is the general inflation rate and assumes no real price increase, and the assumption that interim power can be made up by existing units on the Consumers' system and not through purchased power.

107. Although the Staff's analysis included in its nuclear fuel costs the assumption that plutonium would be recycled, the increased costs associated with no plutonium recycle would not alter the conclusion that the Midland Plant is preferred. (Feld Tr. 4543). Nuclear fuel costs would be increased by approximately 10% on the levelized mills per kwh bases which, while increasing the cost of the Midland Plant slightly, would barely affect the substantial spread in costs between the Midland Plant and the low-sulfur coal alternative. (Feld, Tr. 4545). The levelized cost of the Midland Plant would increase from 43.3 mills per kwh to 44.4 mills per kwh which is substantially below the 52.5 mills pwer kwh identified for the low-sulfur coal option. (Feld Tr. 45[illegible]; Feld Testimony, Table 1, p. 8). Reprocessing costs are embedded in the assumption of plutonium recycle.

108. Dr. Feld identified the 1981 present worth val es for the Midland Plant and low-sulfur coal facility. (Feld, Tr. 5516). The cost for the Midland Plant is 3.816 billion dollars and the cost for the low-sulfur coal facility is 4.54 billion dollars. The effect of no recycle of plutonium and reprocessing on the Midland Plant costs in terms of 1981 present worth dollars would increase the value to 3.917 billion dollars. (Feld, Tr. 4554).

109. The Staff updated its coal cost estimates which affected the cost of replacement power and the cost of the coal alternatives.[1/] The Staff continued to support the 5% escalation factor applied in its analysis which it considers as a conservatism. However, based on more recent information, the Staff determined that base value it presented initially understated the price of coal under new contract. (Feld testimony, p. 1).

110. Based on a review of more recent data which included data gathered from the Federal Power Commission and analysis of the data presented by Consumers,[2/] the Staff developed revised base prices which were then used to update the comparison of alternatives and the cost of replacement power. (Feld testimony, p. 2).

1/ "NRC Staff Supplement Direct Testimony of Sidney Feld Updating Coal Cost Estimates" follows Tr. 5169.

2/ "Testimony of Robert W. Wilkinson" follows Tr. 4881.

111. Employing this revised data, the Staff determined that the Midland Plant was even more economically preferred. The results of the analysis are presented on Table 1. (Feld testimony, p. 3). The most reasonable alternative remains the low-sulfur coal alternative with a 30-year levelized cost of 59.2 mills per kwh as compared to 43.3 mills per kwh for the Midland Plant.

112. The Staff examined the cost-benefit balance with no credit taken for sunk costs. The Staff's analysis was prepared in late 1976 and presented in early 1977 and assumed an in-service date for the coal-fired alternative of January 1, 1984 based on an immediate abandonment of the Midland Plant. The Staff's analysis would be conservative for a later abandonment date for the Midland Plant for, as the abandonment date for Midland is extended, the January 1, 1984 date for the coal-fired alternative becomes less realistic. Consequently, the replacement facility would come on line at a later date at higher cost and a need for more replacement power. Also the sunk costs have increased since the Staff's analysis thereby giving further advantage to the continued construction of the Midland Plant. Thus the Staff's analysis originally demonstrated that the Midland Plant is preferred, and this advantage increases with time.

113. The question of Dow developing facilities to generate its own process steam as an alternative to the purchase of steam from Consumers was raised at the hearing. In order to generate its own steam and electricity, Dow would require new generating facilities. The alternative of modifying existing facilities so that they could continue to operate has been examined by Dow and it has rejected it. (Temple, Tr. 2444-2445). The alternatives to the Midland Plant which were felt to be feasible were examined in the "Comparison of Dow Alternatives for Supplying Steam and Power to the Midland Plant." (Intervenors' Exhibit No. 26). That comparison determined the most favorable alternatives to be either a new coal-fired steam and electric generating facility or gas turbines. However, with regard to gas turbines and the associated coal gasification technology, the stage of development by Dow consists of a prototype unit on which construction has not yet begun. Furthermore, costs for the coal gassification system are less accurate than for a conventional coal system. (Temple, Tr. 2645).

114. The Board finds a conventional coal-fired steam generating plant to be the most reasonable alternative for Dow to generate its own process steam and electricity.[1/]

115. Dow has made an examination of the Dow alternative and the results of this analysis are summarized in Intervenors' Exhibit No. 26. Dow employed its own coal costs in the analysis. Based on Dow's evaluation the Midland Plant is clearly preferable at a 30% return on investment (ROI) and marginally preferrable at a 15% ROi.

1/ This alternative will be referred to henceforth as the "Dow alternative."

116. Consumers has examined the alternative of Dow generating its own process steam and electricity.[1/] In performing its analysis, Consumers used the cost data presented by Dow with the exception of coal costs. Consumers took Dow's 1982 cost assumptions as shown in Case "C", Intervenors' Exhibit No. 26, for feedwater, limestone, operation and maintenance, and capital costs. Brzezinski testimony, p. 3). Consumers concluded that Dow's coal costs grossly understated a reasonable projection of expected coal costs. (Wilkinson testimony, p. 10).[2/] It thus employed the coal costs which it developed.

117. The coal costs used in the Consumers analysis of the Dow alternative and the fossil-fired alternatives were developed using an appropriate base price for either high-sulfur or low-sulfur coal and an appropriate escalation factor to determine the cost of the coal over the life generating units. (Wilkinson testimony, p. 2).

118. The base price of coal identified by Consumers is $1.23/MM BTU for high sulfur coal and $2.19/MM BTU for low-sulfur coal in 1976. Consumers used an escalation rate of 12% for 1977 and 1978, 10% for 1979-1983 and 9% thereafter. (Wilkinson testimony, pp. 3-5).
In addition, revised nuclear fuel costs and revisions in

1/ "Testimony of Richard F. Brzezinski follows Tr. 4959.
2/ "Testimony of Robert W. Wilkinson" follows Tr. 4881.

the projected Dow electric rates consistent with the Company's most recent rate case filing were used. (Brzezinski testimony, p. 5). The results of the analysis made by Consumers is presented in columns 4 and 5 presented at page 7 to the Brzezinski testimony . Consumers concluded that at either a 15% or 30% ROI, the Dow alternative of generating its own process steam and electricity was not economically preferred.

119. The Staff has examined as an alternative to the Midland Plant a combination of facilities which could result if Dow decided to provide its own process steam and electricity requirements.[1] Under this alternative, Dow would build and operate four high-sulfur coal units capable of producing 2400 M lb/hr of steam and 167 MW of electricity and Consumers would construct and operate a low-sulfur coal plant with a net electrical output of 1178 MWe. The combined electrical and steam output from these facilities would equal the output of steam and electricity from the Midland Plant. (Feld testimony, p. 1).

120. The Staff used a cost data developed by Dow in its analysis of alternatives to the Midland Plant with the exception of coal costs. (Case "C", Intervenors' Exhibit No. 26). The coal costs used in the analysis were those updated by the Staff at the hearing.[2]

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[1] "NRC Supplemental Direct Testimony of Sidney E. Feld on the Alternative of Dow Generating its Own Steam and Electric Power" following Tr. 5169.

[2] "NRC Staff's Supplemental Direct Testimony of Sidney Feld Updating Coal Cost Estimates" following Tr. 5169.

121. The Staff presented coal cost information which corroborated the high sulfur and low sulfur base prices selected by Consumers. (Feld testimony, pp. 1-2). However, the Staff employed a more conservative value for escalation in its analysis. (Feld testimony, p. 5). The Staff assumed a 5% annual escalation rate for the price of coal throughout the period of study.

122. For the separate facility to be constructed by Consumers, the Staff analyzed a low-sulfur coal plant as it was found to be more economical than a high-sulfur alternative. The costs associated with an 1178 megawatt electric coal plant were conservatively taken to be directly proportional to the costs associated with the 1600 megawatt electrical coal plant. (Feld testimony, pp. 2-3).

123. The results of the Staff analysis are presented in Table 1 of the Feld testimony. That table compared the Midland Plant with the alternative of self generation by Dow plus a reduced size coal electric plant to be constructed by Consumers. As that table shows, the Midland Plant has a cost advantage of 1.775 billion dollars. (Feld testimony, Table 1).

124. Intervenors also presented testimony on a Dow alternative to the Midland Plant. The alternative proposed would have Dow construct facilities and generate all of its electrical and process steam requirements using coal-fired boilers and would have Consumers construct an 800 megawatt electric coal-fired generating facility (Timm testimony, p. 83).[1/]

125. It was assumed in the analysis that the Dow facilities would be completed by 1982, and the Consumers facility would be completed in 1983. (Timm testimony, p. 83). Capital costs for the coal generating facility and for the Midland Plant were the same costs used by Consumers in its analysis. Capital costs for the Dow facilities were those used by Dow in its analysis. (Timm testimony, p. 85). However, Intervenors did use separately developed coal costs. (Timm testimony, p. 85). The results of Intervenors analysis are presented on Intervenors' Exhibit No. 46.

1/ "Testimony of Richard J. Timm on Behalf of All Intervenors Except Dow Chemical Company" bound in the special transcript volume of March 23, 1977, following Tr. 16A.

126. This exhibit shows a cost advantage of 150 million dollars for the Dow alternative, with no account being taken of Midland Plant costs already sunk. Sunk costs in the project approximate 400 million dollars. (Keeley testimony, p. I-3).[1/] Assigning these sunk costs to the Dow alternative would thus result in a cost disadvantage for that alternative of approximately 250 million dollars.

127. The analysis performed did not include the costs of replacement power for the years 1981-83. Inclusion of such replacement power costs would increase the cost of the Dow alternative. However, Intervenors concluded that the added two years of generating capability associated with the coal alternative coming on-line in 1983 as opposed to the Midland Plant on-line date of 1981 would roughly cancel out the costs associated with replacement power. (Timm testimony, p. 86).

128. Intervenors' expert was cross-examined extensively at the hearing regarding the preparation of Intervenors' Exhibit No. 46. It was brought out upon cross-examination that in developing the Dow alternative, Dr. Timm assumed that the facility would generate 2.8 million pounds of steam per hour. However, this facility was compared with the Midland Plant operating to generate in excess of 4 million pounds of steam per hour for use by Dow. (Timm, Tr. 5450). This difference in effect had the result of not accounting for 74 megawatts of Midland Plant generating capacity in the analysis. (Timm, Tr. 5456).

[1/] This Keeley testimony follows Tr. 602. It should be noted that this value was projected for December 1, 1976. Due to continued construction, this value will have increased.

129. The facility analyzed by Dr. Timm as alternative to the present Midland Plant was a low-sulfur coal plant. (Timm, Tr. 5478). Dr. Timm updated Intervenors' Exhibit No. 46 at the hearing to incorporate the proper steam rate of 2.8 million pounds per hour. (Timm, Tr. 6170). Dr. Timm made additional adjustments to the Dow alternative which produced changes in the total from 1.594 billion to 1.867 billion dollars. (Timm, Tr. 6175). Dr. Timm further adjusted the Dow alternative increasing the Dow capital from 375 million to 422 million dollars to reflect a credit of 35 million dollars to Consumers if the Midland Plant were not built. This changes the cost of Dow generating its own process steam from 1.525 billion to 1.572 billion dollars. (Timm, Tr. 6176). Finally, Dr. Timm updated the nuclear fuel costs which would increase from 922 million dollars to 1.380 billion dollars. (Timm, Tr. 6177). The cost of the Midland Plant calculated by Dr. Timm would then increase from 3.269 billion to 3.727 billion dollars. (Timm, Tr. 6178). Using these modified values, Dr. Timm concluded that the Dow alternative was 288 million dollars cheaper than continued construction of the Midland Plant. (Timm, Tr. 6179).

130. The Board finds that the alternative analysis performed by Intervenors included a consideration of a Consumers coal-fired generating facility which generated a substantially reduced quantity of electricity. That

alternative considered an 800 megawatt electric coal facility for use by Consumers in meeting its load requirements. The Midland Plant, assuming the supply of 2.8 million pounds per hour of process steam to Dow, is capable of generating in excess of 1300 MW of electricity. The Board has determined that a need exists for this full 1300 MWe.[1/] However, even if the full 1300 MWe were not required, continued construction of the Midland Plant as presently designed would obviate the need for additional capacity at a later date.

131. The Board finds that the alternatives analysis performed by Intervenors indicates no cost advantage for the Dow alternative when sunk costs are considered. Intervenors have identified, without regard to sunk costs, a cost advantage of 288 million dollars. Sunk costs to date are approximately 400 million dollars and when this cost is added to the Dow alternative, continued construction of the Midland Plant is economically preferred.

132. The Board finds that the testimony of the Staff and Consumers on the question of the Dow alternative to be more thorough and credible than the testimony presented by Intervenors. Both Staff and Consumers have analyzed the alternative and have shown it to be economically disadvantaged.

[1/] See Paragraphs 21 through 47, infra.

While Intervenors have identified a cost advantage for the Dow alternative without regard to sunk costs, inclusion of sunk costs shows that alternative to be economically disadvantaged. The Board finds that the Dow alternative is economically disadvantaged and so continued construction with the associated investment in the Midland Plant would not tip the cost-benefit balance against this alternative as the balance is already unfavorably tipped.

133. Based on the analyses of both the Staff and the Consumers, the Board finds that the most reasonable alternative to continued construction of the Midland Plant would be the construction of two 800 megawatt facilities to supply both Dow and Consumers. However, this alternative is economically disadvantaged as compared to the Midland Plant by a substantial margin as shown by the analyses of both the Staff and Consumers. Thus the Board finds that there is no reasonable alternative identified which compares favorably to the Midland Plant in economic terms, and so continued construction of the Midland Plant cannot tilt the cost-benefit balance in favor of such an alternative. The Board finds that all alternatives to the Midland Plant are presently disadvantaged and, that while continued construction may increase that disadvantage, continued construction could in no way tilt the balance away from such an alternative.

E. Effects of Delay

134. Both Consumers and the NRC Staff presented testimony as to the effect of a delay in the completion of the Midland Plant beyond its presently scheduled commercial operating dates of March, 1981 for Unit No. 2 and March, 1982 for Unit No. 1. The suspension of construction on the Midland Plant would produce a correspondingly longer period of delay in commercial operation due to the time required to re-start construction at the end of the suspension period. The construction site would have to be prepared for work. The construction force would have to be recruited, organized, and assigned. (Keeley testimony, p. III-1).[1/] (Crocker Testimony, p. 7).[2/]

135. The delay period caused by a suspension of plant construction could not be regained. While there may be some compression possible in the present construction schedule (Keeley, Tr. 3694), it is more likely that even absent a suspension, the Midland Plant will have difficulty meeting its presently scheduled commercial operating dates.[3/] The Midland Plant is scheduled for completion in less than four years. Any significant delay due to a suspension would be extremely difficult to recover in the time remaining for plant construction. (Crocker testimony, pp. 4-7). The Board finds that a suspension of construction on the

1/ This Keeley testimony follows Tr. 3638.
2/ "NRC Staff Testimony of Lawrence R. Crocker Relative to Delay of Construction and Make-Up of Lost Time" follows Tr. 4177.
3/ See Paragraph 79, infra.

Midland Plant would produce a delay in the commercial operation of the plant by a correspondingly greater amount of time due to efforts required to restart the job. The Board further finds that, due to the advance stage of construction, any significant delay would be extremely difficult to recover, especially in view of the fact that a schedule extension could reasonably occur even without the delay.

136. Consumers analysis of the effects of a delay in construction identified substantially increased costs for the Midland Plant and its nuclear fuel, and significant costs for the purchase and/or differential power which would result upon a delay in the commercial operation of the Midland Plant. (Keeley testimony, pp. III-3, III-4).

137. The Staff examined the financial costs associated with delay.[1/] The Staff specifically reviewed the 250 million dollar increase in Midland Plant cost calculated by Consumers and associated with a 9-month suspension. Nuclear fuel costs were not included. (Meltz testimony, p. 1). A large fraction of the cost increase identified by Consumers is associated with the allowance for funds used during construction (AFUDC) and the incremental amount resulting from a suspension of construction will not necessarily involve an out-of-pocket expense borne by Consumers. Until the plant goes into operation, AFUDC is little more than an accounting procedure. However, Consumers

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1/ "NRC Staff Testimony of Arnold H. Meltz on the Financial Costs of Delay (Excluding Replacement Power)" follows Tr. 4573.

ratepayers will see its effect in the form of higher rates once the Midland Plant goes into operation. (Meltz testimony, p. 3). In addition to AFUDC, the Midland Plant cost will increase due to escalation. A 9-month suspension in construction will increase the plant cost by 47 million dollars. (Meltz testimony, p. 4). In addition, additional cost increases associated with shutdown and startup activities will be incurred. (Meltz testimony, p. 6).

138. Intervenors' witness challenged the cost of delay analysis made by Consumers. Dr. Timm testified that Consumers failed to consider the time value of money. (Timm testimony, p. 66). Dr. Timm's testimony was examined in detail by the Staff.[1/] Although the Staff recognized the usefulness of present value techniques (Meltz testimony, p. 5), the Staff nevertheless found Dr. Timm's approach to be deficient. (Meltz rebuttal, p. 1). The Staff identified several errors and inconsistencies in Dr. Timm's methodology. (Meltz rebuttal, pp. 2, 3, 5).

139. For example, the Staff questioned the unrealistic assumption of having ratepayers actually pay fixed charges during the delay period. (Meltz rebuttal, p. 2). Responding to this point in his surrebuttal affidavit,[2/]

1/ "NRC Staff Rebuttal Testimony of Arnold H. Meltz on the Financial Costs of Delay (Excluding Replacement Power)" found in the Special Transcript Volume of March 23, 1977.

2/ "Affidavit of Richard J. Timm in Response to Rebuttal Testimony filed by Consumers Power Company and the Nuclear Regulatory Commission's Staff" dated May 26, 1977.

Dr. Timm stated that Mr. Meltz erred in interpreting his statement as meaning that the ratepayers actually would be paying 220 million dollars during the 9-mongh delay. However, during the course of his cross-examination, Dr. Timm explained his approach in precisely the same way as Mr. Meltz described it. (Tr. 5596, 5597).

140. Even if Mr. Meltz's rebuttal is altered to accommodate Dr. Timm's criticism in his surrebuttal affidavit with respect to present worthing, the end result would be a new zero cost savings to the ratepayers. (Timm affidavit, pp. 36-37). In other words, the so-called savings on the front end would be approximately offset by the present value of the incremental capital costs resulting from either a 9- or 15-month delay. (Meltz rebuttal, p. 6). This result was conceded by Dr. Timm in an alternative approach he stated could be used. (Tr. 5602-03; 5940-41). The Board finds this alternative approach to be more persuasive than the one used in Dr. Timm's direct testimony. Such an approach takes into account the added life of the delayed plant, which Dr. Timm calculated as an added benefit to the ratepayer. Following Dr. Timm's initial approach, the same result would be reached if the value of the added life were offset against the additional payments ratepayers would have to make. (Meltz rebuttal, p. 5). It appears as if the zero cost savings comes about because the 11.75% discount

rate being employed by Consumers Power is approximately equal to the escalation rate built into its projected plant cost increases. If one assumes the 10% discount rate employed by the Staff in its analyses, a delay would result in a net cost to the ratepayers. (Meltz testimony, p. 6).

141. The impact on ratepayers of the projected plant cost increases resulting from either a 9-mongh or 15-month delay is sensitive to the discount rate being used. The Board therefore finds that there is no significant benefit or detriment to the ratepayers with respect to capital cost increases if the 11.75% discount rate is used in conjunction with Consumers Power's projected plant cost increases.

142. The Staff also examined the costs of replacement power resulting from a suspension.[1/] In the Staff's analysis of the cost of replacement power, it conservatively assumed little or no growth on the Consumers' system. Thus the cost estimates developed are modest as they assume that Consumers will be able to make up the energy deficit internally through the utilization of existing capacity. The Staff further assumed that either coal or oil-fired units will be available to make up the energy differences. (Feld testimony, pp. 1-2). The

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1/ "NRC Staff Testimony of Sidney E. Feld on Cost of Replacement Power Resulting from Suspension" follows Tr. 4509.

Staff further examined a range of capacity factors for the Midland Plant were it to be in operation. The results of this analysis are presented in Table 2 of the Feld Testimony. That table shows substantial monthly replacement power costs. During the course of the hearing, the Staff revised its coal cost estimates[1/] and also added an additional conservatism of high-range nuclear fuel costs to its analysis of replacement power.[2/] The Staff's updated analysis is presented in Table 2 of the latter Feld testimony. Replacement power costs range from 3.8 million dollars to 5.3 million dollars per month for coal-fired capacity to 9 million dollars to 12.5 million dollars per month for oil-fired capacity depending on the Midland Plant capacity factor assumed.

1/ See paragraphs ____ to ____, infra.

2/ "NRC Supplement Direct Testimony of Sidney E. Feld Updating Coal Cost Estimates" following Tr. 5169.

143. Intervenors' witness examined Consumers' analysis of the cost of replacement and/or differential power and concluded that that analysis was incomplete and erroneous. (Timm testimony, pp. 69-79). Dr. Timm identified erroneous energy requirements, improper purchases, inflated coal costs, and an unrealistic availability factor for the Midland Plant as the deficiencies in the Consumers' analysis. Dr. Timm was extensively cross-examined on these issues at the hearing. In addition, rebuttal and surrebuttal testimony and affidavits of both Consumers and Intervenors further address these questions.

144. The Board need not reach the issue of whether Consumers correctly developed the costs associated with replacement power in the event of a delay in the Midland Plant. The Board recognizes that the calculations of such costs is a complex and involved procedure as is evidenced by the lengthy cross-examination of Dr. Timm and the extensive affidavits of Messrs Lapinski, Calcaterra and Timm.[1/] However, the record contains the conservative analysis of replacement power costs presented by the NRC Staff. This analysis employed a number of conservative assumptions.[2/] The analysis demonstrated substantial costs for replacement costs ranging from 3.8 to 12.5 million dollars

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1/ "Affidavit of David A. Lapinski on Behalf of Consumers Power Company" dated May 19, 1977; "Affidavit of Ronald Calcaterra on behalf of Consumers Power Company" dated May 19, 1977; and "Affidavit of Richard J. Timm in response to Rebuttal Testimony filed by Consumers Power Company and the Nuclear Regulatory Commission's Staff" dated May 26, 1977.

2/ See paragraphs 142 to 143.

per month depending on the nature of the assumptions involved. Based on this conservative analysis by the Staff, the Board finds that substantial replacement power costs would result in the event the Midland Plant is delayed.

145. The Board further finds that delay of commercial operation of the Midland Plant would adversely affect the supply of reliable electric service to Consumers' customers. A need for additional generating capacity has been demonstrated.[1/] Furthermore, based on an extensive reserve margin analysis of MECS and ECAR, the Midland Plant capacity is required as scheduled.[2/] The Midland Plant is further needed to supply baseload capacity.[3/]

1/ See Paragraphs 21 to 47.
2/ Id.
3/ Id.

F. Clarified ACRS Letter

146. On November 18, 1976 the ACRS issued a "Supplemental Report on Midland Plant, Units 1 and 2." (Staff Exhibit No. 3). The report was prepared by the ACRS in response to the Board's letter of October 14, 1976 directing the ACRS to issue a clarified letter in accordance with the Aeschliman decision.

147. In its report, the ACRS identified the "other items related to large water reactors" which had been previously "identified by the Regulatory Staff and the ACRS" which were in part the subject of the June 18, 1970 ACRS Report on Midland Plant, Units 1 and 2. Following each item the ACRS included an amplifying statement of the item involved. (Staff Exhibit No. 3, p. 1).

148. At the hearing, the Staff provided testimony which addressed the current status of resolution of each of these 11 items as they pertain to the Midland Plant. (Crocker Testimony, p. 1).[1/]

1/ "Analysis of ACRS Report of 11-18-76" following Tr. 4177. The word "draft" appearing in the heading of this testimony was deleted by Mr. Crocker orally at the hearing and he adopted that testimony as his final testimony. (Tr. 4133). Although Mr. Crocker's testimony lacks continuous pagination, the Staff has referred to Mr. Crocker's testimony as pages 1-20 for ease in reference.

149. The Board has reviewed ACRS item No. 1, separation of protection and control instrumentation, and has determined that it is resolved for the Midland Plant which must comply with the requirements of General Design Criteria 22 and 24, and IEEE 279-1971. (Crocker testimony, p. 4).

150. The Board has reviewed ACRS item No. 2, vibration and loose part monitoring, and finds that final decisions have not yet been made as to the necessity for such equipment or the particular type or application of such equipment if ultimately installation is deemed necessary. (Crocker Testimony, p. 5). Consumers, however, has committed in PSAR Amendment No. 5 dated November 3, 1969 to implement a practical and relaible means to identify vibrations and loose parts within the reactor vessel, when such a system is identified by the Staff. (Crocker, Tr. 4296-97). Such equipment would be in the nature of add-on equipment which could be added to the plant at any time. Thus, while there is no present resolution of this item, continued construction will not foreclose solutions and the issue can await resolution at the operating license stage. (Crocker Testimony, p. 5).

The Board has reviewed ACRS item No. 3, potential for axial xenon oscillations. The portion of the concern relating to xenon oscillations is considered resolved for the Midland Plant based on a demonstration of

azimuthal stability of the Oconee Unit No. 1 reactor (essentially identical to the Midland reactors) and the ability of the control system to suppress axial oscillations (Crocker testimony, p. 6). The portion of the ACRS concern relating to the use of poision shims in the fuel elements to make the moderator coefficient more negative at the beginning of life is considered resolved by both the ACRS and the Staff. (Crocker testimony, p. 7).

152. The Board has reviewed ACRS item No. 4, behavior of core-barrel check valves in normal operation. This item has been reviewed and resolved for the Oconee Nuclear Station (essentially identical to the Midland reactors). The Staff there determined that sufficient evidence had been provided by Babcock and Wilcox, the reactor vendor, to assure that the core-barrel vent valves would remain closed during normal operation. The resolution of this matter is directly applicable to the Midland Plant. (Crocker testimony, p. 8-9).

153. The Board has reviewed ACRS item No. 5, the potential consequences of fuel handling accidents. This item is covered by General Design Criterion 61 of Appendix A to 10 C.F.R. Part 50 and Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," which describes an acceptable method for implementing General Design Criterion 61. Consumers has committed to meet the requirements of Regulatory Guide 1.13 and the Board therefore considers this concern resolved for the Midland Plant. (Crocker testimony, p. 10).

154. The Board has reviewed ACRS item No. 6, the effects of blowdown forces on core internals. This item is partially covered by Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing," and Consumers is in full conformance with this guide. The Staff, however, is concerned about loads on reactor internals and this area is under current review. Resolution of this item is not yet final, but the Staff has preliminary indications that the internals design of the Midland Plant is acceptable. Resolution of this item is not affected by continued plant construction. (Crocker testimony, p. 11).

155. The Board has reviewed ACRS item No. 7, assurance that LOCA-related fuel rod failures will not interfere with ECCS function. This item is resolved by compliance with Appendix K to 10 C.F.R. Part 50, which establishes the final acceptance criteria for emergency core cooling systems. The Midland Plant will be required to conform to the requirements of Appendix K and operating plants of the Midland type are presently meeting those requirements. The Board, therefore, finds this matter resolved. (Crocker testimony, p. 12).

156. The Board has reviewed ACRS item No. 8, the effect on pressure vessel integrity of ECCS induced thermal shock. Regulatory Guide 1.2 "Thermal Shock to Reactor Pressure Vessels" covers current requirements on this subject and the Midland Plant meets the requirements of this guide.

The ultimate resolution of this item requires input of fracture mechanics data on irradiated steel from the Heavy Section Steel Technology (HSST) program. Pending confirmatory results from the HSST program, the Board considers conformance to Regulatory Guide 1.2 and the design of pressure vessel in accordance with the ASME code is adequate resolution on the item. If irradiation damage to the Midland vessel is greater than anticipated, the vessel can be annealed to restore it toughness properties. Thus resolution of this item is not affected by continued construction. (Crocker testimony, p. 13).

157. The Board has reviewed ACRS item No. 9, environmental qualification of vital equipment in containment. This item is governed by various Regulatory Guides and by a series of IEEE standards. (Crocker testimony, p. 14). The Staff is currently reviewing compliance of the Midland Plant with these various guides and IEEE standards and this review is not complete. Completion will not occur until the Staff review of the operating license application for Midland is made. However, this matter deals exclusively with components, rather than structures, and continued construction of the plant would not preclude possible upgrading of components to meet final criteria which are placed upon those components by the Staff. Thus while this item is not resolved, its resolution can be left to the operating license stage and will not be affected by continued construction. (Crocker testimony, p. 15).

158. The Board has reviewed ACRS item No. 10, instrumentation to follow the course of an accident. The part of this concern relating to the possible buildup of hydrogen in the containment is covered by General Design Criterion 41 and Regulatory Guide 1.7 "Control of Combustable Gas Concentrations in Containment Following a Loss of Coolant Accident." Consumers has committed to comply with the design guidance and assumptions for analysis contained in Regulatory Guide 1.7 and the Board finds this design approach to be acceptable. Final system design and the supporting analyses will be reviewed at the operating license stage. The Board thus considers this part of the concern resolved. (Crocker testimony, p. 16-17). The second part of this concern relates to instrumentation to follow the course of an accident. Since the instrumentation finally installed for the Midland Plant need not be selected until late in the construction phase, continued construction will not affect the resolution of this item and it can be deferred to the operating license stage. (Crocker testimony, p. 17).

159. The Board has reviewed ACRS item No. 11, improved quality assurance and in-service inspection of primary system. Quality assurance requirements for the Midland Plant are covered by Appendix B to 10 C.F.R. Part 50 and numerous Regulatory Guides. During a recent review by the Staff to determine the extent of conformance of the Midland Plant to the various

Regulatory Guides, Consumers elected to upgrade the quality assurance program. The Staff has reviewed the revised information submitted, and concluded that the quality assurance program for the Midland Plant is acceptable. (Crocker testimony, p. 18-19). The in-service inspection portion of this concern is covered by compliance with the ASME Boiler and Pressure Vessel Code, Section XI, and Regulatory Guide 1.65, "Materials and Inspections for Reactor Vessel Closure Studs." The Board finds that the matter of in-service inspection is therefore resolved. (Crocker testimony, p. 19-20).

160. The Board finds that the ACRS by its November 18, 1976 letter has identified the concerns to which it referred in the original ACRS report of June 18, 1970 for the Midland Plant. The Board further finds that the Staff has examined each of these 11 items to determine the status of each item with regard to the Midland Plant. The Staff has determined in the majority of the cases that the present plant design resolves the concern. In the remaining instances, the Staff has determined that, while resolution is not presently complete, the nature of the resolution is such that plant construction can continue pending such resolution. The Board concurs in these findings reached by the Staff and finds that the 11 items identified by the ACRS are either adequately resolved at present or can be left for later resolution without being affected by continued construction.

III. CONCLUSIONS OF LAW

161. The Board has reviewed the entire record of this proceeding and concludes that the record contains sufficient information to support the specific conclusions that follow.

162. The Board concludes that no significant adverse environmental impacts will occur if construction activities continue until a decision is reached on the remand.

163. Based on a long-term energy sales forecast adequately incorporating the historical and anticipated affects of energy conservation and other relevant factors. The Board concludes that Consumers has a need for the electric generating capacity of the Midland Plant in 1981-82 in order to provide reliable electric service to its customers.

164. Because of regulatory constraints as well as considerations of reliability, Dow must replace its process steam generating units as

soon as possible. Dow's present intent is to purchase its requirements for process steam from the Midland Plant, if presently projected capital costs and commercial operation dates are maintained. While reasonably subject to change, the record evidence indicates that the capital costs and commercial operation dates for the Midland Plant will reasonably approximate those presently projected. With regard to the other factors identified at the hearing as affecting Dow's commitment, these are secondary to Dow's stated corporate position to take process steam from the Midland Plant. The Board concludes that Dow has a need for the steam generating capacity of the Midland Plant.

165. Continued construction of the Midland Plant until a decision is reached on the remand will not foreclose reasonable alternatives in the area of energy conservation as the historical and anticipated effects of energy conservation have been considered in the load growth projections and demonstrate that the full capacity of the Midland Plant is required in the time-frame projected for its commercial operation. Even without a need for its full capacity, a re-design of the Midland Plant to provide reduced capacity is not feasible.

166. Continued construction during the period until a decision is reached on the remand will not foreclose the adoption of design changes for items in the November 18, 1976 ACRS letter which are presently unresolved for the Midland Plant. Design alternatives to those items which are pending resolution are such that continued construction will not foreclose them.

167. Nor will continued construction foreclose the adoption of alternatives related to the changed circumstances regarding Dow.

168. Suspension of the construction permits during the period until a decision is reached on the remand would have serious effects on Consumers, and all the users of the electricity to be produced by the Midland Plant. Delay of the Midland Plant would result in a less reliable electric system. Consumers would experience significantly increased costs for replacement power due to the delay. A suspension of construction, with the attendant delay in the commercial operation date of the plant and increased capital costs will create uncertainty as to whether the Midland Plant will be on-line in time to serve Dow possibly causing Dow to abandon the nuclear project.

169. The cost-benefit balance for the Midland Plant will not be tilted away from the alternative of abandonment by the increased investment made in the plant if construction continues during the period until a decision is reached on the remand. The evidence is clear that the Midland Plant is the preferred alternative to meet the demands of electricity and steam.

170. General Public Policy concerns weigh in favor of continued construction of the Midland Plant. The impacts of a suspension will be felt by Consumers' ratepayers, Consumers' investers, the local community and the workers who would be affected by the suspension. Furthermore, due to the established need for additional electrical generating capacity, a suspension of the Midland Plant would require substantial quantities of replacement power with associated depletion of scarce oil and gas fuels.

171. The Board concludes that the extent of the NEPA violation in this instance is of some magnitude. The Board concludes that the objections raised by Intervenors to the NEPA review conducted by the Commission were timely raised.

172. With regard to the fuel cycle issue, the Board reaches the following conclusions. Reasonable alternatives are not identifiable and so the question of their foreclosure by continued construction does not arise. This view is supported by the Commission in its General Statement of Policy where it expressed the belief that "it is extremely unlikely that the revised environmental survey will result in any modification of these facilities. Only the possibility of discontinuing their construction or use is likely to be at issue."[1/]

[1/] General Statement of Policy, p. 5.

The question then associated with the Aeschliman fuel cycle issue is not foreclosure of alternatives, but continued construction. In view of the economic advantage associated with the continued construction of the Midland Plant, the Board finds that the environmental impacts associated with the fuel cycle could not tilt the balance away from continued construction of the Midland Plant.

173. Balancing the factors involved in this proceeding: the fact that no significant adverse environmental impacts will occur due to continued construction; the fact that alternatives will not be foreclosed by further construction; the fact that the need for electricity and steam from the Midland Plant has been demonstrated; the fact that a suspension of construction would have an adverse impact upon Consumers and the users of electricity from the Midland Plant; the fact that a suspension of construction would adversely affect Consumers' ratepayers and investors, the workers at the project, the surrounding the community, and stated national energy objectives; the fact that increased investment during the period in question will not tilt the balance in favor of the Midland Plant; the fact that the NEPA violation is of some magnitude; and the fact that Intervenors have timely raised their objections, this Board concludes that the equities favor the continued construction of the Midland Plant pending the outcome of the hearing on the remanded issues.

IV. ORDER

On the basis of 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 that the Director of Nuclear Reactor Regulation should not terminate, suspend or modify the construction permits previously issued with respect to the Midland Plant, Units 1 and 2.

IT IS FURTHER ORDERED, in accordance with 10 CFR §§2.760, 2.762, 2.764, 2.785 and 2.786 that this Initial Decision shall become effective immediately and shall constitute with respect to the matters covered therein the final action of the Commission thirty (30) days after the date of 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 seven (7) days after service of this Initial Decision, and a brief in support of such exceptions may be filed by any party within fifteen (15) days [twenty (20) days in the case of the Staff] thereafter. Within fifteen (15) days of the filing and service of the brief of the appellant [twenty (20) days in the case of the Staff], any other party may file a brief in support of, or in opposition to, the exceptions.

Repectufully submitted,

Richard K. Hoefling

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Counsel for NRC Staff

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CONSUMERS POWER COMPANY	)	Docket Nos. 50-329
	)	50-330
(Midland Plant, Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "BRIEF OF THE NUCLEAR REGULATORY COMMISSION STAFF" and "NUCLEAR REGULATORY COMMISSION STAFF'S FINDINGS OF FACT AND CONCLUSIONS OF LAW" and "NUCLEAR REGULATORY COMMISSION STAFF'S PROPOSED TRANSCRIPT CORRECTIONS", dated July 1, 1977 in the above-captioned proceeding, have been served on the following by deposit in the United States mail, first class or air mail, thid 1st day of July, 1977:

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