Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P.O. BOX 2046, MILWAUKEE, WI 53201

June 20, 1979

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. NUCLEAR REGULATORY COMMISSION
Washington, D. C. 20555

Attention: Mr. Ronald L. Ballard, Chief
Environmental Projects Branch #1

Gentlemen:

DOCKET NO. STN 50-502
ADDITIONAL INFORMATION - ENVIRONMENTAL REPORT
HAVEN NUCLEAR PLANT

Enclosed are Applicants' responses to your request for additional information regarding the Environmental Report - Haven Nuclear Plant as transmitted by your letter dated May 15, 1979. We are providing 25 copies of these responses.

Should you have any questions regarding this information, please contact us.

Very truly yours,

C. W. Fay

C. W. Fay, Director
Nuclear Power Department

Enclosure

313 101

(135)

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NRC QUESTION 1 (NRC Letter dated May 15, 1979)

Please provide the updated versions of tables in Chapter 1 and revise the rest of sections in that chapter (in Amendment 9) based on the current demand forecasts. Since the updated demand growth scenario is significantly different from the projections appearing in the tables in Amendment 9,* the analysis and tables, including those listed below, should be revised accordingly.

a. Tables 1.1-1 to 1.1-11 (Amendment 9)

b. Analyses: (i) the second paragraph, p. 1.1-4; (ii) Wisconsin Utilities Weather Correction of August Peak Demand, pp. 1.1-4 - 1.1-5; (iii) Section 1.1.1.2 - Demand Projection, pp. 1.1-5.

RESPONSE:

A complete update of Chapter 1 was presented in Section S.1, Single Unit Supplement, of Amendment 14 to the Environmental Report.

313 192

NRC QUESTION 2 (NRC Letter dated May 15, 1979)

Revise, if necessary, the load duration curves (Figures 1.1-5 to 1.1-10) in light of the updated load characteristics based on the gas availability, rate reforms, and other assumptions reflected in the updated growth scenario. If the load duration curves are expected to remain the same, please explain why.

RESPONSE:

This information was provided in Section S.1, Single Unit Supplement, of Amendment 14 to the Environmental Report.

213 193

NRC QUESTION 3 (NRC Letter dated May 15 1979)

Please revise Tables 1.1-14 and 1.1-16 to 1.1-18 and the analyses in Section 1.1.2, if necessary, due to the updated demand scenario. If the updated demand scenario is not expected to affect the capacity planning and capacity factors, reserve margin, reliability and outage rate, please explain why for each listed item above (if necessary, provide the investment criteria indicating the cost effectiveness of the decisions with regard to the above issues).

RESPONSE:

This information was provided in Section S.1, Single Unit Supplement, of Amendment 14 to the Environmental Report.

313 194

NRC QUESTION 4 (NRC Letter dated May 15, 1979)

In Amendment 9, Sections 1.2 and 1.3 are missing. Provide these sections and analyze the consequences of delay in light of the updated demand forecast and capacity expansion plan. Assuming one to three years delay for the planned operation year, and the applicants had to fine replacement energy from the source indicated in the table below, what is your best estimate of the numbers in the following table (1978 dollars)? Indicate the most favorable source of energy supplies in the case of purchasing electricity (Column 8). What are the cost estimates of the alternatives during the planned life of the proposed station?

	High Sulfur Coal	Low Sulfur Coal	Oil	Turbine	Nuclear	Hydro	Purchase*
a. Fuel Cost (mills/KWh)							
b. Operating and Maintenance Cost (mills/KWh)							
c. Total Operating Cost							
d. Capital Cost (mills/KWh)							
e. Percent of Replacement Energy Generated							

* Please identify, as far as practical, the name of utility company.

RESPONSE:

Sections 1.2 and 1.3 were included in Amendment 9 immediately following the tables and figures for Section 1.1. These sections were updated in Amendment 14.

313 195

The problem of finding replacement energy for any proposed generating unit for which the in-service date is delayed, depends on when the delay is identified. If it is known early in the project schedule, it may be possible to construct substitute generating capacity requiring a shorter lead time. If no new construction is possible, the only viable options are to attempt to negotiate to purchase power or failing to do that to make every attempt to sustain system operation by developing emergency plans which could include such programs as delay of scheduled maintenance on existing units, voltage reduction, etc. However, these techniques are most suitable for part of a year rather than several years.

The Applicants have studied the delay of the unit from 1987 to 1989 if identified in 1979. This alternate plan advanced the construction of a 600 MW and a 400 MW coal-fired unit to 1987 and 1988, respectively. Since the planning is done on a WUMS (Wisconsin) basis, the system of Madison Gas and Electric Company is included in the study. The method of comparison used expresses cost in terms of present worth of future revenue requirements. The total additional cost of the two year delay of Haven by the year 2019 would be $80,000,000 on a January 1, 1979 basis, or $220,000,000 on a January 1, 1989 basis ($25,000,000 annually on a 30 year levelized basis). It is emphasized that this type of analysis should only be done by considering the impact on the entire system and not on a simple unit replacement basis. The Applicants also believe that the only viable alternative to construction of nuclear generation is coal-fired generation and preliminary studies have favored low sulfur coal.

The option to purchase replacement energy for a unit delay in the 1987 to 1989 time period is not available since utilities can not identify how much, if any, firm capacity they will have available that far into the future. Therefore, it has to be assumed that purchases can not replace the capacity of the proposed 900 MW unit.

313 197

NRC QUESTION 5 (NRC Letter dated May 15, 1979)

Provide current KWh sales (1977) volume of the Applicants, WUMS and MAIN by customers [residential, agricultural, commercial, industrial (retail and wholesale), etc.].

RESPONSE:

1978 energy sales (not 1977) are as follows:

	Applicant		WUMS		MAIN	
	MWH	%	MWH	%	MWH	%
a. Residential & Agricultural	8,929,662	29.6	9,669,242	29.1	NOT	
b. Commercial	6,643,839	22.0	7,542,243	22.7		
c. Industrial Retail Wholesale	10,279,112	34.0	10,653,715	32.1	AVAILABLE	
d. Public	4,333,958	14.3	5,281,127	15.9		
e. Other	24,885	0.1	26,471	0.1		
TOTAL	30,211,456	100.0	33,172,798	100.0		

313 198

NRC QUESTION 6 (NRC Letter dated May 15, 1979)

Please complete data and methodologies updating the demand forecast for Wisconsin Power and Light, Wisconsin Electric Power System, and Wisconsin Public Service. Provide the annual projections of the three utilities separately in a tabular form used in Table 1.1-18 (Amendment 11). Demonstrate the procedure and assumption in integrating the projections of the three individual utilities to construct the updated version of Table 1.1-18 shown in Amendment 11. (A flow chart can assist the demonstration of the logical structure of the process.)

RESPONSE:

Methodologies relating to the demand forecast, a part of Section S.1 in Amendment 14, are included in the Response to Question 8. The annual projections of the three utilities, which collectively make up the projection shown in Table S.1.1-18 (Amendment 14), are attached. The values shown for each utility are added to produce the integrated table.

313 199

WISCONSIN ELECTRIC POWER COMPANY

DEMAND, CAPACITY, AND RESERVE DATA PROJECTIONS
(1979 - 1989)

Year	Peak Demand (MW)	Net Firm Sales (Purchases) (MW)	Adjusted Demand (MW)	Generating Capability (MW)	Net Non-Firm Purchases (Sales) (MW)	Adjusted Capability (MW)	Reserve (MW)	Reserve (Percent)
1979	3523	(182)	3341	3781	100	3881	540	16.2
1980	3597	73	3670	4358	0	4358	688	18.7
1981	3676	78	3754	4358	0	4358	604	16.1
1982	3796	84	3880	4677	0	4677	797	20.5
1983	3896	90	3986	4877	0	4877	891	22.4
1984	4011	96	4107	4877	0	4877	770	18.7
1985	4136	101	4237	4877	0	4877	640	15.1
1986	4275	(33)	4242	4877	0	4877	635	15.0
1987	4413	163	4576	5471	0	5471	895	19.6
1988	4560	173	4733	5471	0	5471	738	15.6
1989	4718	174	4892	5711	0	5711	819	16.7

WISCONSIN PUBLIC SERVICE CORPORATION

DEMAND, CAPABILITY, AND RESERVE DATA PROJECTIONS (1979 - 1989)

Year	Peak Demand (MW)	Net Firm Sales (Purchases) (MW)	Adjusted Demand (MW)	Generating Capability (MW)	Net Non-Firm Purchases (Sales) (MW)	Adjusted Capability (MW)	Reserve (MW)	Reserve (Percent)
1979	1087	(12)	1099	1410	(40)	1370	271	24.7
1980	1186	(70)	1116	1410	0	1410	294	26.3
1981	1257	(91)	1166	1410	0	1410	244	20.9
1982	1324	63	1387	1710	0	1710	323	23.3
1983	1404	(50)	1354	1694	0	1694	340	25.1
1984	1447	(61)	1386	1694	0	1694	308	22.2
1985	1510	(64)	1446	1694	0	1694	248	17.2
1986	1571	(118)	1453	1694	0	1694	241	16.6
1987	1641	(81)	1560	1868	0	1868	308	19.7
1988	1695	(95)	1600	1868	0	1868	268	16.8
1989	1751	(22)	1729	2018	0	2018	289	16.7

WISCONSIN POWER & LIGHT COMPANY

DEMAND, CAPABILITY, AND RESERVE DATA PROJECTIONS (1979 - 1989)

Year	Peak Demand (MW)	Net Firm Sales (Purchases) (MW)	Adjusted Demand (MW)	Generating Capability (MW)	Net Non-Firm Purchases (Sales) (MW)	Adjusted Capability (MW)	Reserve (MW)	Reserve (Percent)
1979	1303	(19)	1284	1656	(45)	1611	327	25.5
1980	1344	(21)	1323	1656	0	1656	333	25.2
1981	1395	(10)	1385	1656	0	1656	271	19.6
1982	1436	(131)	1305	1656	0	1656	351	26.9
1983	1474	(6)	1468	1825	0	1825	357	24.3
1984	1516	7	1523	1825	0	1825	302	19.8
1985	1566	10	1576	1825	0	1825	249	15.8
1986	1607	(11)	1596	1825	0	1825	229	14.3
1987	1655	73	1728	2007	0	2007	279	16.1
1988	1711	83	1794	2007	0	2007	213	11.9
1989	1754	30	1784	2007	0	2007	223	12.5

NRC QUESTION 7 (NRC Letter dated May 15, 1979)

Provide the description of the proposed rate reform and demonstrate the expected impacts on load characteristics (seasonal, time of day, and sectoral) and conservation. Provide the study results of rate reform and other conservation measures by the applicant or by others relevant to the applicant's demand analysis.

RESPONSE

Included in materials and report submitted in Response to Question 10.

313 203

NRC QUESTION 8 (NRC Letter dated May 15, 1979)

Provide necessary updates of the exhibits and analysis in Appendix B.

RESPONSE:

Under separate cover, the following are provided:

1. Forecasting methodologies of Wisconsin Electric Power, Wisconsin Power and Light, and Wisconsin Public Servce.
2. MAIN Coordinated Bulk Power Supply Program (supersedes MAIN Appendix A Report).

313 204

NRC QUESTION 8a (NRC Letter dated May 15, 1979)

Explain the difference between some of the entries of Table 1.1-11 and column 2 of Table 1.1-18 (Amendment 11).

RESPONSE:

Table 1.1-11 shows the net power exchanges (both firm and non-firm sales or purchases), while column 2 of Table 1.1-18 shows only the net firm sales or purchases of the Wisconsin Utilities. Column 5 of Table 1.1-18 shows the net non-firm sales and purchases. These tables were both updated in Amendment 14.

313 205

NRC QUESTION 8b (NRC Letter dated May 15, 1979)

Define the term "non-firm" in power-exchange agreements with other utilities. Identify the name of the company which has the exchange agreement ("firm" and "non-firm") (Tables 1.1-11 and 1.1-12 in the ER).

RESPONSE:

A non-firm transaction is that which the supplier can discontinue or reduce in magnitude if delivery would necessitate curtailment of the supplier's own native system load or would otherwise jeopardize the supplier's system operations.

The data shown in Table S.1.1-11 of Amendment 14 reflect transactions (actual and projected) under agreements between each Applicant utility and other utilities externally interconnected with the combined systems of each Applicant. The utilities with which Applicants have agreements are Commonwealth Edison Co., Madison Gas & Electric Co., Northern States Power Co., Upper Peninsula Power Co., combined Cities of Kaukauna and Menasha, and the City of Cedarburg. The data shown in Table S.1.1-12 of Amendment 14 reflect transactions (actual and projected) under agreements between each WUMS utility and other utilities externally interconnected with the combined systems of WUMS. The utilities with which WUMS has agreements are Commonwealth Edison Co., Edison Sault Electric Co., Northern States Power Co., combined Cities of Kaukauna and Menasha, City of Cedarburg, and the City of Marquette and the City of Escanaba.

313 206

NRC QUESTION 8c (NRC Letter dated May 15, 1979)

What is the estimated effects of the system reliability level and reserve margin due to the operation of the proposed unit? Please provide the relationship between the loss of load probability and reserve margin with and without the proposed unit for Wisconsin utilities, and if possible, for WUMS and MAIN. Compare the reserve margin and the system reliability with and without the operation of the proposed unit. Please provide the 1978 report of MAIN Guide 6.

RESPONSE:

As indicated in Section S.1.1.3 of Amendment 14, the Wisconsin Utilities, as part of WUMS and hence of MAIN have adopted a 15 percent minimum installed reserve criterion. MAIN adopted the 15 percent minimum reserve requirement after conducting studies which evaluated variations in assumed forced outage rates for units, help from interconnections, unit size and load forecast uncertainty. The studies were performed using the concept of probability of positive margin (POPM) at the time of system peak. WUMS (excluding UPP) has adopted a policy, consistent with that of MAIN as a whole, that system reliability will be adequate if system planning is based on maintaining an installed reserve margin at the time of system peak of 15 percent or greater. Generation expansion plans are developed by WUMS to meet expected load growth and the minimum installed reserve criterion of 15%.

Since WUMS and hence the Applicants are part of MAIN for reliability analysis purposes, they do not perform loss of load probability (LOLP) analyses on their system. Therefore, LOLP versus reserve margin data is not available.

313 207

The effect on the Applicants' reserve margin with and without the proposed 900 MW nuclear unit and 50 MW combustion turbine is discussed in Section S.1.3 and shown on Figure S.1.3-1 of Amendment 14. The label "MAXIMUM RESERVE CRITERION" should be corrected to read "MINIMUM RESERVE CRITERION" with the label arrow pointing to the 15 percent reserve margin line. The reserve levels drop to 7.4, 4.0 and 5.1 percent in the years 1987, 1988 and 1989 respectively without the proposed installations which are very inadequate.

The 1978 Annual Report of the MAIN Guide No. 6 Working Group is attached.

313 208

May 4, 1978

ANNUAL REPORT OF MAIN GUIDE NO. 6 WORKING GROUP

Abstract

MAIN Guide No. 6 establishes a procedure for determining minimum generation reserve requirement for MAIN as an aid in planning future generation. This guide uses the Probability of Positive Margin (POPM) approach to determine the level of protection.

Guide No. 6 states "that a Probability of Positive Margin of 0.9996 would come close to alignment with other standards in the industry" and is "approximately equal to not having a reserve margin once in five years on a loss of capacity basis and once in ten years on a loss of load basis".

Results

The Working Group has performed studies to test planned generation levels using the POPM method with the unit outage rates shown on Exhibit I. The results of these studies for the period 1978-1987 are tabulated in Exhibit II. In essence, the studies show:

1. The present generation program as described in "MAIN's 1978 Reply to Appendix A-2 of Order 383-4, dated April 1, 1978" will provide adequate reserves throughout the ten-year period except for 1986 in which a deficit of 750 MW is expected to occur. In making the analyses, credit was taken for interconnections using the twice MAIN technique.

2. The Working Group also used the POPM technique to study individual areas within MAIN, including Commonwealth Edison, Wisconsin-Upper Michigan, Missouri, Illinois (excluding Commonwealth Edison), and Ill-Mo. The purpose of this phase of the group's work was to provide meaningful planning data for members of the areas studied, for other working groups and for the Engineering Committee.

   A summary of the results of this study is contained in Exhibit III.

During the course of the Working Group's activities, a "MAIN Guide No. 6 Special Report, 1978" was prepared. This special report recommends adoption of the use of Loss of Load Probability (LOLP) methodology for future MAIN reserve requirement analysis.

313 209

EXHIBIT I

Forced Outage Rates for Use in MAIN Generation Reserve Study

Nominal Rating MW	Fossil Drum-Type Immature	Fossil Drum-Type Mature	Fossil Once-Thru Immature	Fossil Once-Thru Mature	Nuclear Immature	Nuclear Mature	Twin Boilers Immature	Twin Boilers Mature	Common Header Immature	Common Header Mature
50	2.0	1.5							2.0	1.5
100	4.5	3.5					3.5	2.5	3.0	2.0
200	5.0	4.0			4.5	3.0	4.0	3.0		
300	7.0	5.0								
400	7.0	5.0	10.0	7.0						
500	7.5	5.5	11.0	8.0	7.5	4.5				
600	10.0	7.0	12.0	9.0	10.0	6.0				
800	10.0	7.0			11.0	6.0	9.0	6.0		
1100	10.0	7.0			12.0	7.0				

	Immature	Mature
Gas Turbines	8.0	6.0
Jet Engines	10.0	8.0
Diesel	9.0	7.0
Hydro	1.5	1.0
Pumped Hydro	3.0	1.5

313 210

EXHIBIT II

Future MAIN System (1)
1978 - 1987

Year	Adjusted Capacity	Adjusted Demand MW	% Reserve	POPM (2) 2% Standard Deviation	Additional Generation Required (2) to Maintain POPM of .99960 with 2% Standard Deviation: Additional MW (3)	% Reserve
1978	41,353	33,859	22.13	1.00000	0	--
1979	43,325	36,102	20.01	.99999	0	--
1980	45,378	38,220	18.73	.99994	0	--
1981	47,994	39,996	20.00	.99999	0	--
1982	52,308	42,321	23.60	1.00000	0	--
1983	56,419	44,855	25.78	1.00000	0	--
1984	57,194	47,182	21.22	.99999	0	--
1985	58,370	49,615	17.65	.99978	0	--
1986	59,895	52,128	14.90	.99817	750	16.34
1987	64,344	54,796	17.42	.99981	0	--

(1) All results are based on data as reported to the Energy Regulatory Administration in MAIN's 1978 Reply to Appendix A-2 of Order 383-4, April 1, 1978.

(2) Includes the effect of help from interconnections by using the study techniques of considering a twice MAIN system.

(3) MW required to be added within MAIN to achieve the desired POPM.

313 211

Subject: Reserve Analysis for Individual Areas Within MAIN Using POPM Approach

Individual area POPM analysis was first done by the Working Group in 1974 to gain a feel for the magnitude of generation forced outage that might occur within a given area. This provided data that was useful for review of interconnection capability.

The present Working Group repeated this work for the years 1979, 1983, and 1987. The results are tabulated on Pages 2, 3 and 4 of this Exhibit.

313 212

1979 POPM Runs for
Individual Areas Within MAIN

Area	Adj. Cap. MW	Adj. Dem. MW	Res. %	POPM(1)	Import Req'd. MW(2)	Add. Cap. Req'd. MW(3)	Res. %(4)
WUMS	8413	7009	20.0	.9804	810	870	32.4
ILL	8417	6657	26.4	.9803	990	1060	42.2
MO	9253	7840	18.0	.9058	1680	1790	40.9
ILL-MO	17670	14497	21.9	.9807	1490	1590	32.9
CE	17242	14596	18.1	.9307	2440	2610	36.0

(1) Using 5% forecast uncertainty.

(2) Import required from interconnections to eliminate negative margin at POPM of .9996.

(3) Additional owned capacity required to achieve POPM of .9996 with no help from interconnections.

(4) Excess of Adj. and Add. Cap. over Adj. demand as % of demand.

313 213

1983 POPM Runs for
Individual Areas Within MAIN

Area	Adj. Cap. MW	Adj. Dem. MW	Res. %	POPM(1)	Import Req'd. MW(2)	Add. Cap. Req'd. MW(3)	Res. %(4)
WUMS	10139	8714	16.4	.9375	1360	1450	33.0
ILL	10473	8211	27.5	.9809	1190	1270	43.0
MO	12049	9622	25.2	.9679	1570	1680	42.7
ILL-MO	22522	17833	26.3	.9931	1310	1400	34.1
CE	23758	18308	29.8	.9908	1810	1930	40.3

(1) Using 5% forecast uncertainty.

(2) Import required from interconnections to eliminate negative margin at POPM of .9996.

(3) Additional owned capacity required to achieve POPM of .9996 with no help from interconnections.

(4) Excess of Adj. and Add. Cap. over Adj. demand as % of demand.

313 214

1987 POPM Runs for Individual Areas Within MAIN

Area	Adj. Cap. MW	Adj. Dem. MW	Res. %	POPM(1)	Import Req'd. MW(2)	Add. Cap. Req'd. MW(3)	Res. %(4)
WUMS	12520	10400	20.4	.9701	1340	1430	34.1
ILL	11928	9977	19.6	.9462	1690	1810	37.7
MO	15038	12121	24.1	.9669	1880	2010	40.6
ILL-MO	26966	22098	22.0	.9824	2070	2210	32.0
CE	24858	22298	11.5	.7592	4640	4950	33.7

(1) Using 5% forecast uncertainty.

(2) Import required from interconnections to eliminate negative margin at POPM of .9996.

(3) Additional owned capacity required to achieve POPM of .9996 with no help from interconnections.

(4) Excess of Adj. and Add. Cap. over Adj. demand as % of demand.

313 215

NRC QUESTION 8d (NRC Letter dated May 15, 1979)

Please explain the increase in generating capability of 1105 MW during 1986 to 1987 in Table 1.1-18. In addition, the staff is unsure of the relationship between the 5th column of Table 1.1-18 and the 2nd column of Table 1.3-1 regarding the impact of Haven units on adjusted capacity and the schedule for bringing Haven up to full capacity.

RESPONSE:

The increase in generating capability of 1105 MW during 1986 to 1987 in Table 1.1-18 (Amendment 11) is due to the installation of the Haven nuclear unit (900 MW), the Haven combustion turbine (50 MW), and the switch from summer to winter capability (155 MW). This does not appear in the revised Table S.1.1-18 included in Amendment 14.

The discrepancy between Tables 1.1-18 and 1.3-1 has been corrected in Amendment 14.

313 216

NRC QUESTION 8e (NRC Letter dated May 15, 1979)

Provide historical and estimated growth for the service area of the following variables: population, number of households, per capita income, consumer price index, manufacturing output, gross regional product, trends in size of household, energy use per residential customer, saturation by major appliance and price of alternative fuels. Data should cover the 15 years prior to the date of application through the third year of commercial operation of the proposed unit. Please describe explicitly how the variables are reflected in the applicant's demand forecasting model.

RESPONSE:

Wisconsin Electric Power Company

The attached table provides the data requested with the following explanation:

1. The data for population and total per capita income refer only to the Milwaukee, Kenosha and Racine SMSA's;
2. Rather than including the actual index values, the CPI data are presented in terms of percentage changes from year to year.
3. The electric space-heating saturation data were calculated as the percentage of new residential dwellings that install electric heat. No other measure of space-heating saturations was used in making the demand forecast;
4. All other data are as labeled.
5. None of the data for the Wisconsin Electric WIS-MICH Division is incorporated in this tabulation.

313 217

The horizontal lines divide actual data from forecast values; above the line are actuals, below it the forecasts.

The population, total per capita income, Consumer Price Index, and energy use per residential customer values were not used explicitly in the current forecast. An econometric modeling effort, nearing completion, generated the forecasts and they were used judgmentally in the official forecast. The saturation numbers were used to account for changes in consumer demand for electricity due to rate structure reform.

313 218

Wisconsin Electric Power Company

Historical and Estimated Growth of Service Area Variables

Year	Population (000's)	Total Per Capita Income (Mil. 72$)	Milw CPI % Growth (1972 = 1.0)	Energy Use Per Residential Customer (000's Mwh)	Room A/C Saturation %	Central A/C Saturation %	Electric Space Heating Saturation %
62	1603	3.683	1.32	4.31			
63	1581	3.880	.98	4.42			
64	1607	4.019	1.08	4.61			
65	1628	4.203	2.02	4.85			
66	1650	4.402	2.30	5.08	18.2	4.8	
67	1654	4.536	2.04	5.33	21.5	4.1	
68	1681	4.604	3.50	5.65	24.7	5.5	
69	1656	4.739	5.80	5.98	29.4	5.6	
70	1705	4.657	5.75	6.25	29.0	7.1	
71	1709	4.704	3.71	6.48	38.3	8.6	
72	1715	4.993	3.00	6.70	38.1	9.6	
73	1725	5.212	6.31	6.86	41.3	10.6	
74	1727	5.245	9.60	6.66	42.1	11.5	
75	1712	5.190	8.93	6.98	41.3	12.9	
76	1694	5.303	5.35	6.97	40.0	15.2	
77	1681	5.447	6.06	7.16	39.2	17.9	31.0
78	1687	5.549	5.63	7.32	40.0	21.0	34.0
79	1674	5.748	6.00	7.50	"	22.0	38.0
80	1662	5.898	6.46	6.67	"	23.0	42.0
81	1661	5.963	6.53	7.81	"	24.0	45.0
82	1662	5.997	7.03	7.93	"	25.0	47.0
83	1669	6.057	6.64	8.05	"	26.0	49.0
84	1677	6.121	6.45	8.15	"	27.0	49.5
85	1680	6.191	5.90	8.24	"	28.0	50.0
86	1686	6.265	5.57	8.32	"	29.0	"

313 219

Wisconsin Electric Power Company

Historical and Estimated Growth of Service Area Variables

Year	Population (000's)	Total Per Capita Income (Mil. 72$)	Milw CPI % Growth (1972 = 1.0)	Energy Use Per Residential Customer (000's Mwh)	Room A/C Saturation %	Central A/C Saturation %	Electric Space Heatin Saturation %
87	1691	6.318	5.39	8.38	"	30.0	"
88	1703	6.387	5.05	8.43	"	31.0	"
89	1713	6.427	5.15	8.47	"	32.0	"
90	1723	6.462	5.10	8.50	"	33.0	"
91	1736	6.544	4.66	8.52	"	34.0	"
92	1747	6.612	4.71	8.54	"	35.0	"

313 220

WISCONSIN POWER & LIGHT COMPANY

Response to Question 8e - NRC Data Request

Application of the Specified Variables to the WPL Demand Forecast

1. Population - Data on population growth in the civil divisions served by Wisconsin Power and Light Company ws obtained from the U.S. census and the annual updates done by the Wisconsin Department of Administration - Demographic Services Center. Changes in population over time were analyzed to determine the extent of customer growth from migration and/or natural increase. The analysis of age cohort groups has shown a strong relationship between male births in the Company's service area and new residential customers about 25 years later. Household formation rates are thus derived from population data which is the basis for annual customer additions in the forecast. Commerical customers have been observed to increase at a rate of about one for each twelve new residences so that population was also used to determine the rate of growth for that major customer class.

2. Per Capita Income - Data on annual income for WPL customers was used to aid in judgementally determining the future growth rates of various household appliances among the residential class. Knowledge of the existing saturation rates and income levels within the service area permitted comparisons with the same type of data at the national level. Average monthly KWH usage was also analyzed at different income levels to examine the relationship of usage to income.

3. Consumer Price Index - This was not used directly in the forecast process. A comparison of the index of average annual electric bills to the Consumer Price Index was made to determine that price of electricity in the Company's service area was rising faster than the index of all consumer goods.

4. Manufacturing Output - This variable was not used in the demand forecast process.

5. Gross Regional Product - No data available for WPL service area - was not used in the demand forecast process.

6. Trends in Size of Household - The decline in the size of household has been observed in the counties served by WPL. This has been projected to continue over the forecast period and because some appliance usage levels are a function of family size (example, water heating), this factor was an important consideration in using a fairly constant average KWH use level throughout the 1980's.

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7. <u>Energy Use Per Customer</u> - This factor was projected based on appliance saturation levels, household size, expected changes in the real price of electricity, and improvements in appliance efficiencies. The use per customer was multiplied by the number of customers projected to produce the annual energy requirements for a given class. The demand forecast was checked for reasonableness by comparing its annual growth rate with the energy growth rate after allowing for possible changes in the annual load factor.

8. <u>Saturation by Major Appliance</u> - Periodic surveys were made of the WPL residential customers to determine ownership levels of major appliances. The change in ownership or saturation levels has been plotted over time to observe the growth rate and to aid in projecting the maximum level and the year in which it will be reached. The pattern is generally an elongated S-curve with the adoption rate varying for each appliance. The saturation levels for the WPL service area are generally higher than the national levels and the maximum points will likely be reached by the mid 1980's for all except the microwave oven. The saturation curves have been used to develop judgement as to when the overall appliance mix will reach a maximum level and the annual KWH usage level will reach its peak. The saturation curves for room and central air conditioners were particularly important in determining the temperature-sensitive portion of the annual demand growth. For WPL, the air conditioning saturation reaches the maximum level at 54% in 1988.

9. <u>Prices of Alternate Fuels</u> - Costs for oil, natural gas and electricity were examined for the past eight years and trended to determine if the relative costs would change by an amount significant enough to trigger fuel switching by homeowners, particularly from fossil fuels to electric heat. Historically, there has been relatively little shifting except where natural gas has been extended into a community. The shifts from fossil to electric have not occurred because of the substantially higher cost of electric heat. The growth of electric heat that is projected in the WPL forecast is largely due to the nonavailability of natural gas for new hookups during the 1990's.

Additional data are provided under separate cover.

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Question 8e: Wisconsin Public Service Corporation (WPSC)

Population

A tabulation of historical and projected growth for the WPSC service area is included. The 18-64 population growth rate drives the growth rate projection for residential customer numbers used in the demand forecast.

Number of Households

A tabulation of the number of households (farm plus non-farm) in the WPSC service area is included. Household numbers are estimated to be the sum of the number of residential customers and the number of farm customers in the WPSC service area. For each year of the forecast period, non-farm residential customer growth rate is calculated to be 1.7 times the percentage increase in the 18-64 population age group for the WPSC service area.

The residential forecast is based on three groups of residential customers:

> "EXISTING" customers are those non-electric space-heating customers served by WPSC at the end of 1976. Increases in residential households are allocated to the remaining two groups. "NEW" residential customers include non-electric space heating customers added since January 1, 1977. "ESH" includes all prior electric space heating customers and annual increases in this category.

Separate demand forecasts are computed for each of the three residential customer groups, ESH, NEW, and EXISTING. Separate sets of appliance values have been developed to represent the different characteristics of these three groups.

Farm number (household) projections are used to compute a demand forecast for the farm residential load in a manner identical to the computation of the residential customer group forecasts. The number of farm customers is projected to decrease linearly from 10,500 in 1978 to 9,500 in 1998.

Per Capita Income

A tabulation of historical per capita income for the counties in the WPSC service area is included. No projections of per capita income are included. WPSC does not use per capita income as a variable in its forecasting methodology.

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Consumer Price Index (CPI)

A tabulation of the U. S. All City Consumer Price Index for the years 1960 through 1978 is included. An adjusted CPI for the WPSC service area is not available. No CPI projections are used in the WPSC forecasting methodology.

Manufacturing Output

A tabulation is included listing value added by manufacturing for selected years for the 16 counties in the WPSC service area. Manufacturing output was not listed as values are available, at this time, for 1967 and 1972 only. No projections are available. Neither manufacturing output or value added are used as variables in the WPSC forecasting methodology.

Gross Regional Product

No reliable values for gross regional product for the WPSC service area could be obtained. This variable is not used in the WPSC forecasting methodology.

Trends in Size of Household

A tabulation is included listing trends in household sizes for the WPSC service area. Household sizes are computed for selected years for which precise population values, either from census data or population projections, are available. The trend of decreasing household sizes was incorporated, judgmentally, in the residential appliance value projections for the forecast period.

Energy Use Per Residential Customer

A tabulation of historical and projected energy use per residential customer for the WPSC service area is included. The historical values were obtained from WPSC annual reports. Future values were obtained from the WPSC end-use residential electric forecast. Energy use per residential customer is a result, not a driving variable in the WPSC load forecasting methodology.

Saturation by Major Appliance

Tabulations of projected saturations for residential appliances are included for the three groups of residential customers, ESH, NEW, and EXISTING. The saturation values are used as shown in the following equations:

KWH = Customer Numbers x Saturation x KWH per Appliance

KW = Customer Numbers x Peak Factor x Saturation x KWH/Appliance

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Historical appliance saturation values for the WPSC service area are not available.

Price of Alternative Fuels

A tabulation of historical residential prices for natural gas, No. 2 fuel oil, and propane is included. These values were collected from different sources. They are not claimed to be accurate, weighted average prices for the WPSC service area. WPSC uses prices of alternative fuels in a judgmental manner for developing forecasting assumptions. Projections of alternative fuel prices are not developed in the WPSC forecasting methodology.

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WISCONSIN PUBLIC SERVICE CORPORATION

SERVICE AREA POPULATION

Year	Age 0-17	Age 18-64	64 and over	Total
1960	189 762	253 859	51 713	495 334
1970	210 071	298 22[illegible]	63 016	571 312
1975*	20[illegible]	334 912	69 937	605 956
1980*	197 [illegible]	371 765	78 178	647 561
1985*	2[illegible]6	405 260	85 228	695 844
1990*	223 596	431 532	90 435	745 563
1995*	236 951	458 701	94 123	789 775

* Calculated from State of Wisconsin Population Projections, June 1975.

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WISCONSIN PUBLIC SERVICE CORPORATION

NUMBER OF HOUSEHOLDS IN SERVICE AREA

Actual		Projected	
Year	Households	Year	Households
1960	131 863	1979	217 663
1961	133 853	1980	225 054
1962	135 662	1981	232 116
1963	137 758	1982	238 632
1964	140 004	1983	245 344
1965	142 823	1984	252 254
1966	146 194	1985	259 371
1967	149 984	1986	265 801
1968	154 680	1987	271 224
1969	159 349	1988	276 765
1970	162 850	1989	282 425
1971	167 845	1990	288 209
1972	173 437	1991	294 055
1973	179 283	1992	299 946
1974	184 935	1993	305 963
1975	190 428	1994	312 105
1976	196 548	1995	318 377
1977	203 459	1996	325 573
1978	210 664	1997	333 962

Households are estimated to be equal to the sum of residential customers and farm customers.

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WISCONSIN PUBLIC SERVICE CORPORATION

16 COUNTY TOTALS*

PER CAPITA PERSONAL INCOME (RESIDENCE ADJUSTED)**
(Dollars)

County	1959	1965	1970	1973
Brown	2028	2497	3458	4365
Calumet	1862	2527	3646	4774
Door	1695	2197	3207	4176
Forest	1220	1512	2194	2731
Kewaunee	1546	1904	2928	3721
Langlade	1382	1833	2761	3579
Lincoln	1636	1921	2914	3619
Manitowoc	1905	2424	3420	4296
Marathon	1696	2207	3248	4221
Marinette	1559	1956	2708	3542
Oconto	1342	1639	2560	3286
Oneida	1756	2245	3299	4170
Portage	1768	2208	2906	3849
Vilas	1627	2229	2857	3393
Waupaca	1630	2097	3150	3834
Winnebago	2317	2934	3789	4692

* Not adjusted for the actual WPSC service area.
** Source: Wisconsin Department of Planning and Budgets.

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WISCONSIN PUBLIC SERVICE CORPORATION

CONSUMER PRICE INDEX

U. S. ALL CITY AVERAGE

Year	End of Year Value	Average Value
1960	89.3	88.7
1961	89.9	89.6
1962	91.0	90.6
1963	92.5	91.7
1964	93.6	92.9
1965	95.4	94.3
1966	98.6	97.2
1967	101.6	100.0
1968	106.4	104.2
1969	112.9	109.8
1970	119.1	116.3
1971	123.1	121.3
1972	127.3	125.3
1973	138.5	132.0
1974	155.4	146.2
1975	166.3	161.2
1976	174.3	170.5
1977	186.1	181.5
1978	202.9	195.4

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WISCONSIN PUBLIC SERVICE CORPORATION

16 COUNTY TOTALS*

VALUE ADDED BY MANUFACTURING
(Millions of Dollars)

County	1958	1963	1967	1972
Brown	122.7	186.8	282.4	383.6
Calumet	21.1	31.6	58.1	87.2
Door	8.7	7.9	15.6	22.2
Forest	2.9	2.7	5.0	7.9
Kewaunee	8.9	13.5	20.1	25.7
Langlade	5.5	8.7	8.9	15.8
Lincoln	23.4	32.4	37.8	46.0
Manitowoc	95.6	110.3	147.0	194.7
Marathon	64.9	88.4	132.2	194.3
Marinette	43.9	50.8	72.0	90.5
Oconto	14.9	---	22.0	41.8
Oneida	19.3	24.5	21.4	31.5
Portage	17.1	22.3	32.2	40.1
Vilas	2.2	2.3	5.4	8.2
Waupaca	23.0	21.2	33.9	51.5
Winnebago	160.3	215.8	270.9	355.3

*These values represent entire counties. They are not adjusted for the actual WPSC service area.

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WISCONSIN PUBLIC SERVICE CORPORATION

SERVICE AREA

HOUSEHOLD TRENDS

Year	Number of Households	Persons/ Household
1960	131 863	3.76
1970	162 850	3.51
1975	190 428	3.18*
1980	225 054*	2.88*
1985	259 371*	2.68*
1990	288 209*	2.59*
1995	318 377*	2.48*

* Estimated based on population projections

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WISCONSIN PUBLIC SERVICE CORPORATION

ENERGY USE PER RESIDENTIAL CUSTOMER
(Kilowatthours)

Actual		Projected	
Year	KWH	Year	KWH
1960	3614	1979	6960
1961	3762	1980	7001
1962	3910	1981	7046
1963	4038	1982	7083
1964	4186	1983	7133
1965	4415	1984	7169
1966	4531	1985	7220
1967	4766	1986	7250
1968	5081	1987	7280
1969	5294	1988	7299
1970	5609	1989	7332
1971	5768	1990	7353
1972	5953	1991	7412
1973	5988	1992	7453
1974	6324	1993	7508
197	6526	1994	7551
1976	6712	1995	7625
1977	6939	1996	7693
1978	7029	1997	7778

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WISCONSIN PUBLIC SERVICE CORPORATION

APPLIANCE SATURATION PROJECTIONS FOR ESH CUSTOMERS (PERCENT)

YEAR	REF	MISC	TV	HEAT	WH	COOK	COOL*	DRY	FRZ	DEH**	DWSH	CWSH
1977	100	100	100	100	100	100	27	70	34	40	51	70
1978	100	100	100	100	100	100	29	70	35	40	52	70
1979	100	100	100	100	100	100	31	70	36	40	53	70
1980	100	100	100	100	100	100	33	70	37	40	54	70
1981	100	100	100	100	100	100	35	70	38	40	55	70
1982	100	100	100	100	100	100	37	70	39	40	56	70
1983	100	100	100	100	100	100	39	70	40	40	57	70
1984	100	100	100	100	100	100	41	70	41	40	58	70
1985	100	100	100	100	100	100	43	70	42	40	59	70
1986	100	100	100	100	100	100	45	70	43	40	60	70
1987	100	100	100	100	100	100	47	70	43	40	61	70
1988	100	100	100	100	100	100	49	70	44	40	62	70
1989	100	100	100	100	100	100	51	70	44	40	63	70
1990	100	100	100	100	100	100	53	70	45	40	64	70
1991	100	100	100	100	100	100	55	70	45	40	65	70
1992	100	100	100	100	100	100	56	70	46	40	66	70
1993	100	100	100	100	100	100	57	70	46	40	67	70
1994	100	100	100	100	100	100	58	70	47	40	68	70
1995	100	100	100	100	100	100	59	70	47	40	69	70
1996	100	100	100	100	100	100	60	70	48	40	70	70
1997	100	100	100	100	100	100	61	70	48	40	71	70
1998	100	100	100	100	100	100	62	70	49	40	72	70

* Air conditioning
** Dehumidifier

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WISCONSIN PUBLIC SERVICE CORPORATION

APPLIANCE SATURATION PROJECTIONS FOR NEW CUSTOMERS (PERCENT)

YEAR	REF	MISC	TV	HEAT	WH	COOK	COOL*	DRY	FRZ	DEH**	DWSH	CWSH
1977	100	100	100	100	53	63	8	51	26	20	38	50
1978	100	100	100	100	45	55	10	50	28	25	40	57
1979	100	100	100	100	40	50	12	51	29	26	42	60
1980	100	100	100	100	37	47	14	52	30	27	44	60
1981	100	100	100	100	35	45	16	53	31	28	45	60
1982	100	100	100	100	35	45	18	54	32	29	46	60
1983	100	100	100	100	35	45	20	55	33	30	47	60
1984	100	100	100	100	35	45	22	56	34	31	48	60
1985	100	100	100	100	35	45	24	57	35	32	49	60
1986	100	100	100	100	35	45	26	58	36	33	50	60
1987	100	100	100	100	35	45	28	59	37	34	51	60
1988	100	100	100	100	35	45	30	60	38	35	52	60
1989	100	100	100	100	35	46	32	61	39	36	53	60
1990	100	100	100	100	35	46	34	62	40	36	54	60
1991	100	100	100	100	35	47	36	63	41	37	55	60
1992	100	100	100	100	35	47	38	64	42	37	56	60
1993	100	100	100	100	35	48	40	65	43	38	57	60
1994	100	100	100	100	35	48	42	66	44	38	58	60
1995	100	100	100	100	35	49	44	67	45	39	59	60
1996	100	100	100	100	35	49	46	68	46	39	60	60
1997	100	100	100	100	35	50	48	69	47	40	61	60
1998	100	100	100	100	35	50	50	70	48	40	62	60

* Air conditioning
** Dehumidifier

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WISCONSIN PUBLIC SERVICE CORPORATION

APPLIANCE SATURATION PROJECTIONS FOR EXISTING CUSTOMERS (PERCENT)

YEAR	REF	MISC	TV	HEAT	WH	COOK	COOL*	DRY	FRZ	DEH**	EWSH	GWSH
1977	100	100	100	100	30	52	27	31	39		23	56
1978	100	100	100	100	30	52	29	32	39	24	25	57
1979	100	100	100	100	30	52	31	33	40	25	27	58
1980	100	100	100	100	30	52	33	34	40	25	29	59
1981	100	100	100	100	30	52	35	35	41	26	31	60
1982	100	100	100	100	30	52	37	36	41	26	33	61
1983	100	100	100	100	30	52	39	37	42	27	35	62
1984	100	100	100	100	30	52	41	38	42	27	37	63
1985	100	100	100	100	30	52	43	39	43	28	39	64
1986	100	100	100	100	30	52	45	40	43	28	41	65
1987	100	100	100	100	30	52	47	41	44	29	43	66
1988	100	100	100	100	30	52	49	42	44	29	45	67
1989	100	100	100	100	30	52	51	43	45	30	47	68
1990	100	100	100	100	30	52	53	44	45	30	49	69
1991	100	100	100	100	30	52	55	45	46	31	51	70
1992	100	100	100	100	30	52	56	46	46	31	53	71
1993	100	100	100	100	30	52	57	47	47	32	55	72
1994	100	100	100	100	30	52	58	48	47	32	57	73
1995	100	100	100	100	30	52	59	49	48	33	59	74
1996	100	100	100	100	30	52	60	50	48	33	61	75
1997	100	100	100	100	30	52	61	51	49	34	63	76
1998	100	100	100	100	30	52	62	52	49	34	65	77

* Air conditioning
** Dehumidifier

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WISCONSIN PUBLIC SERVICE CORPORATION

PRICES OF ALTERNATIVE FUELS

RESIDENTIAL CUSTOMERS

Year	Natural Gas Cents/Therm	No. 2 Fuel Oil Cents/Gallon	Propane Cents/Gallon
1965	9.1	16.5	15.4
1966	9.0	16.0	16.9
1967	8.[illegible]	16.0	16.9
1968	8.9	16.3	16.9
1969	8.9	17.9	16.9
1970	8.9	20.0	19.0
1971	9.1	18.0	17.0
1972	10.0	19.0	19.0
1973	12.5	19.0	26.2
1974	12.5	34.9	33.3
1975	15.7	37.7	33.8
1976	19.9	41.9	41.1
1977	21.5	45.9	47.6
1978	27.0	45.9	45.9

This information was collected from various sources. It is considered to be a general representation of residential heating fuel prices in the WPSC service area for the years listed. These values are not claimed to be accurate weighted average fuel prices for the WPSC service area.

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NRC QUESTION 8f (NRC Letter dated May 15, 1979)

The staff is unsure of the assumptions and analysis applied in addressing the following issues. Please expand and provide the analytical procedures, assumptions, and relevant reference.

a. The extent of the price induced conservation efforts and increases in electric sales due to unavailability of gas (first paragraph, TAB 3, p. 3, Appendix B).

b. The percentage of new customer choosing electric heat (sixth paragraph, TAB 3, p. 4, Appendix B).

c. Choosing the 10% reduction of annual electric usage without changing standard of living significantly (seventh paragraph, TAB 3, p. 5, Appendix B). Please provide references, if possible.

d. The number of new customers (5,200) over the period 1978-2000.

e. Last paragraph of TAB 5, p. 2 of Appendix B.

f. The result of a computer study of SIC codes (TAB 5, p. 2, Appendix B). Please provide the result of the study.

RESPONSE:

These questions are moot in light of the updated methodology submitted in Response to Question 8.

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NRC QUESTION 8g (NRC Letter dated May 15, 1979)

Define in quantitative terrs baseload, intermediate, and peaking load used in the description of function of the applicant's system (Table 1.1-4). Given the definition above, provide the baseload, intermediate, and peak energy requirement during the period of 1967 to 1997 (or up to 1991).

Provide the functions of generating capacity and energy requirement based on the baseload defined as average load during the period of 1967 to 1991 (or up to 1991).

Provide the minimum hourly load for the current year and for the first year of commercial operation of the unit.

Please provide the anticipated loading order of units available to the applicants for each of the seasons of the year, and identify th function of unit as defined above.

RESPONSE:

The term baseload would generally describe a generating unit with an annual capacity factor in the range from 50 percent or greater and one that is almost continuously synchronized to the power system. The term intermediate would generally describe a generating unit with an annual capacity factor in the range from 20 to 50 percent and one that is operated only when required by system demand. The term peaking would generally describe a generating unit with an annual capacity factor in the range from 1 to 20 percent and one that normally operates on weekdays, if required. There are no rigid transition points between functions and what is described as a baseload unit on one system may be described as an intermediate unit on another. Also, a unit may operate as a baseload unit for part of the year and as an intermediate unit for the remainder of the year. The function of units can also change as additional

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units are brought into service and because of changes of load patterns.

The definitions of baseload, intermediate and peaking load for the generating units listed in Table 1.1-14 can not be related to the energy requirements as requested in the second sentence of this question. The annual requirement for energy is determined by customer demand and not generating unit function. It is the summation of the individual daily load curves, each of which is supplied from the generating system by the most economic generating units available for operation at the time. The actual choice of units is dependent upon mechanical availability, fuel supply, environmental restrictions or other consideratons The definitions of functions of generating units are not related to the customer demands and can not be used for the determination of energy requirements.

The above discussion also applies to the request to provide data based on the baseload defined as average load.

The minimum hourly load for the Wisconsin Utilities was 1850 MW in 1978. For 1988, the first full year of operation of the Haven unit, it is projected to be 2446 MW.

The anticipated loading order of units available to the Applicants in the summer of 1989 is shown on the attached table and does not change with seasons. The anticipated function of each unit in 1989 is also shown.

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Response to NRC Question 8g

Wisconsin Utilities
Anticipated Loading Order of Units
1989

Wisconsin Electric

Unit	Function*
Hydro	B
Point Beach 2	B
Point Beach 1	B
Haven 1	B
Oak Creek 8	B
Oak Creek 7	B
Oak Creek 6	B
Oak Creek 5	B
Oak Creek 4	B
Oak Creek 3	B
Oak Creek 1	B
Oak Creek 2	B
Port Washington 5	I
Valley 1	I
Hydro	I
Edgewater 5	I
Pleasant Prairie 2	I
Pleasant Prairie 1	I
1989 Coal	I
Port Washington 3	I
Port Washington 4	I
Port Washington 1	I
Port Washington 2	I
Valley 2	I
Germantown CT 4	P
Germantown CT 3	P
Germantown CT 2	P
Germantown CT 1	P
Haven CT	P
Commerce Street	P
Oak Creek CT	P
Lakeside CT	P
Port Washington CT	P
Point Beach CT	P
Valley Diesel	P

Wisconsin Public Service

Unit	Function*
Hydro	B
Kewaunee 1	B
Haven 1	B
Columbia 1	B
Columbia 2	B
Edgewater 4	B
Weston 3	B
Pulliam 7	B
Pulliam 8	B
1989 Coal	I
Pulliam 6	I
Weston 2	I
Pulliam 5	I
Weston 1	I
Pulliam 3	I
Pulliam 4	I
Weston 32	P
West Marinette 32	P
West Marinette 31	P
Weston 31	P
Haven CT	P
Eagle River Diesels	P

Wisconsin Power & Light

Unit	Function*
Hydro	B
Kewaunee 1	B
Haven 1	B
Columbia 1	B
Columbia 2	B
Edgewater 4	B
Nelson Dewey 1	B
Nelson Dewey 2	B
Edgewater 5	I
Edgewater 3	I
Rock River 1	I
Rock River 2	I
Blackhawk 3	I
Blackhawk 4	I
Haven CT	P
Sheepskin CT	P
Rock River 5 CT	P
Rock River 6 CT	P
Rock River 3 CT	P
Rock River 4 CT	P

NOTES: (1) B - Base; I - Intermediate; P - Peaking
(2) Loading order does not change with the season of the year.
* See text. Utilities do not normally classify capacity in this manner.

NRC Question 9a (NRC letter dated May 15, 1979)

Please provide the following information on capital costs of building 900 MWe Haven in whatever form is convenient.

Direct Costs	Haven Nuclear	Haven Coal (With Scrubbers
Land		
Structures and Site		
Reactor/Boiler Equipment		
Turbine Plant		
Other Contingency		
Sub-Total		
Indirect Costs		
Construction Facilities and Services		
Engineering and Construction Management		
Sub-Total		
Total		
Total Direct and Indirect		
Allowance for Escalation		
Allow for Interest on Funds Used During Construction		
Total Cost at Date Commercial Operation		

RESPONSE

The response to this question is provided in Table S.9.2-54 of Amendment 14 to the Environmental Report.

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NRC Question 9b(NRC letter dated May 15, 1979

What is the makeup of the nuclear 16% fixed charge rate for Haven? Explain the use of a different fixed charge rate for coal (16.5%).

RESPONSE

The 16% fixed charged rate for nuclear and the 16.5% fixed charge rate for coal are not longer current. The most recent fixed charge rates used in the coal vs. nuclear comparison are provided in Table S.9.2-55 of Amendment 14 to the Environmental Report. The fixed charge rate differs for coal and nuclear plants because each type of plant has a different tax life, book life, insurance rate and pre-inservice (construction) period. The 20.5% nuclear plant fixed charge rate contains the following components.

Cost of money	8.9
Depreciation	5.2
Property Tax	2.2
Income Tax	3.9
Insurance	.3
Total	20.5

313 242

NRC Question 9c (NRC letter dated May 15, 1979)

What is the projected uranium fuel cost in dollars for Haven for the lifetime of Haven plant? Please indicate the estimated cost of yellowcake ($ per lb) for the above fuel costs.

RESPONSE

The 30 year levelized nuclear fuel cost for Haven, as stated in Table S.9.2-54 of the Environmental Report, is 21.2 mills/kwhr or approximately $3,760,000,000 for the first 30 years of Haven Plant operation. This nuclear fuel cost estimate assumes a yellowcake price of $41.30 per pound in 1980 dollars which escalates at 6% per year.

313 243

NRC Question 9d (NRC letter dated May 15, 1979)

Please indicate the formula used in annualizing (levelizing) total costs.

RESPONSE

The formula used in levelizing total costs is:

Levelizing factor to be applied to present day cost =

$$\frac{\frac{1}{1+i}\left[\frac{1-\left(\frac{1+r}{1+i}\right)^{n}}{1-\left(\frac{1+r}{1+i}\right)}\right]}{\frac{(1+i)^{n}-1}{i\,(1+i)^{n}}}$$

where

i = discount rate (11%)
r = assumed rate of inflation (6%)
n = number of year over which costs are levelized (30 yrs)

313 244

NRC Question 9e (NRC letter dated May 15, 1979)

Please indicate how the difference between the value of electricity produced (11.1-1) and the cost of Haven to produce it (11.1-2) is composed. Please update these benefit and cost estimates for planned change from two to one unit operation including opearating dates, construction period, and other affected areas such as employment.

RESPONSE

The value of electricity produced (11.1-1) is taken from Table 8.1-1 "Benefits From the Proposed Facility" and is based upon the expected average annual generation (kilowatt hours) from the facility and the 1974 average revenue per kilowatt hour increased by a 5% per year escalation factor. The total annualized cost of the facility, including annual fixed charges, annual fuel cost, annual operation and maintenance costs and the annualized transmission system cost, are then substracted from the value of electricity produced to obtain the net economic benefit of the proposed facility. Updated benefit and cost estimates for the single unit operation are included in the Single Unit Supplement, Amendment 14 to the Environmental Report.

313 245

NRC QUESTION 9f (NRC Letter dated May 15, 1979)

Please fill in the following table for WU's firm contracts:

	Uranium Fuel	Low Sulfur Coal	High Sulfur Coal
1. Delivered Cost per Ton			
2. Delivered Cost per BTU x 10^6			
3. Beginning and Ending Data for Contract			
4. Tons/Year Contracted for			

RESPONSE:

The assumptions regarding nuclear and coal plant fuel costs are contained in Table S.9.2-55 of Amendment 14 to the Environmental Report. These costs are based upon the Wisconsin Utilities best estimate of future fuel prices and, while they include consideration of present firm contracts, such current contract data cannot be simply extrapolated to obtain future fuel costs. Because of the large volume of contract data involved, we suggest that a meeting be arranged in Wisconsin Electric offices to review the available data and to determine what, if any, use can be made of the data in the review process.

313 246

NRC Question 9g (NRC letter dated May 15, 1979)

To the extent possible, please indicate the relative forecasted growth in fuel cost (percent escalation) of uranium, low surlfur, and high sulfur coal in the next 20 years. (Please relate to Table 9.2-48; is the. a typographical error in Item 6.b?)

RESPONSE

The assumed rate of escalation for all fuel types, including uranium, low sulfur coal and high sulfur coal, in the next 20 years is 6% per year. There is no typographical error in Item 6.b of Table 9.2-48, however, please note that Table 9.2-48 depicts the asumptions used in the original 1974 comparison not the current economic comparison.

313 247

NRC QUESTION 10a (NRC Letter dated May 15, 1979)

Please provide hearing materials and reports on the applicant's rate reform, load management, and the need for power forecasts prepared by the applicants, PSC, and others to various agencies including PSC, state regulatory agencies, FERC and DOE.

RESPONSE:

Under separate cover, the following items of materials and reports, segregated by applicant utility, relating to rate reform, load management, and the need for power forecasts are provided:

Wisconsin Electric Power Company

Rate Reform:

1. PSCW Order, dated August 18, 1977 in Docket CA-5489, authorizing construction of Pleasant Prairie Unit #1 with a condition to the development of a program to achieve 100 MW of interruptible load control.
2. Letter to PSCW, dated May 12, 1978, submitting interruptible rates.
3. PSCW Order, dated December 19, 1978 in Docket 6630-ER-9, establishing an interruptible tariff.
4. PSCW Interim Order, dated January 5, 1978 in Docket 6630-ER-2/5, establishing time-of-day rates.
5. PSCW Order, dated July 20, 1978 in Docket 6630-34-2/5, finalizing time-of-day rates.

313 248

6. Load Management Report of February 16, 1979 in response to PSCW Order of January 5, 1978 in Docket 6630-ER-2/5.
7. PSCW Order, dated March 6, 1979 in Docket 6630-ER-8, establishing time-of-day rate for other commercial and residential customers.
8. MPSC Order, dated April 24, 1979 in Case No. U-5996, establishing time-of-day rates for general secondary and primary customers in addition to providing for participation by residential customers in load management program.

Load Management:

1. PSCW Order, dated July 8, 1976 in Docket CA-5489, authorizing preliminary construction of Pleasant Prairie Unit #1 with a condition that an application be submitted with measures to control and reduce system peak by load management programs.
2. Application to PSCW, dated November 24, 1976, submitting course of action to control and reduce system peak demand.
3. Load Management Program CP75-03, dated April, 1975.
4. Letter to PSCW, dated February 3, 1978, submitting Load Management Program CP77-07, dated December 1977.

313 249

5. Letter from PSCW, dated March 14, 1978, Dockets CA-5489, 6630-ER-2, and 6630-ER-5.

6. Testimony of R. A. Abdoo, Load Management Hearings April 1978.

7. Testimony of Glen Lokken, Load Management Hearings April 1978.

8. Letter from PSCW, dated June 30, 1978 in Docket 6630-CE-12, authorizing purchase of load control receivers.

9. Letter from PSCW, dated September 27, 1978, Docket 6630-CE-12.

10. Letter to PSCW, dated May 31, 1979, submitting progress report.

Need for Power:

1. Application to PSCW to construct Haven Nuclear Plant.

2. Letter response to PSCW, dated November 28, 1978 in Docket 05-CE-5, clarifying Haven Nuclear Plant Environmental Report.

3. 20-Year Demand Forecast, Report CP78-02, dated July 1978.

4. 20-Year Demand Forecast, Report CP79-02, dated April 1979.

313 250

NRC Question 10b (NRC letter dated May 15, 1979)

Is there any storage facility operated or planned to be operated by the applicant? Provide analysis of its impact on load management, if available.

RESPONSE

There is no storage facilities operated or planned to operated by Applicants.

313 251

NRC QUESTION 11 (NRC letter dated May 15, 1979)

Why did WEPCo decide to use a factor of 3.16 persons per household for Sheboygan County and 3.31 for Manitowoc County. (2.2-1)

RESPONSE

The factors for persons per household for Sheboygan and Manitowoc are taken from United States Department of Commerce, Bureau of the Census. General Population Characteristics - 1979 Census of Population Final Report P.C.(1)-B51.

313 252

NRC QUESTION 12a (NRC letter dated May 15, 1979)

If there are any potential land use conflicts between Haven and the "Sheboygan County Comprehensive Outdoor Recreation and Open Space Plan 1975," please list them. (2.2-9)

RESPONSE

There are only a few potential land use conflicts with the "Sheboygan County Comprehensive Outdoor Recreation and Open Space Plan 1975" that would result from construction and operation of the Haven Nuclear Plant. They are:

1. Partial filling of the environmental corridor associated with the west branch of Sevenmile Creek,
2. Restriction of access to 1900 feet of the shoreline of Lake Michigan during construction,
3. A change in the visual setting due to the visibility of plant structures from the environmental corridors within the site, and
4. A restriction of hunting within the site boundaries.

These potential impacts are discussed in Section 2.2.2.2 of the Environmental Report.

313 253

NRC QUESTION 12b (NRC letter dated May 15, 1979)

If there are any potential land use conflicts between the "Recreation and Open Space Plan for Manitowoc County, March 1975" and Haven, please list them. (2.2-9)

RESPONSE

There are no potential land use conflicts between Haven and the "Recreation and Open Space Plan for Manitowoc County."

313 254

NRC QUESTION 14a (NRC Letter dated May 15, 1979)

Give names and locations of present mobile home parks in the plant area and areas within 10 miles where new mobile home parks are legal possibilities. (4.1-3)

RESPONSE:

There are five mobile home parks within a 10 mile radius of the Haven Nuclear Plant site. Listed below are the names of the mobile home parks, distances and directions from the site, capacities (numbers of spaces), and occupancy rates.

Mobile Home Parks Within
10 Miles of Haven Nuclear Plant

Name	Distance & Direction from Site	Capacity No. of Spaces	Current Occupancy No. of Spaces
1. Cleveland Heights Mobile Home Park	5.0 NNW	59	58
2. Bain's Incorporated	7.0 SW	92	92
3. Forest Ave. Mobile Home Park	8.25 SW	160	158
4. Indian Meadows Mobile Home Subdivision	9.0 S	133	132
5. Sommers Mobile Homes Inc.	9.5 S	115	115

Mobile home parks are legal possibilities at any location within the 10 mile radius area either as permitting uses or conditional uses under local zoning ordinances. The mobile home parks must meet local building code, sanitary and floodland shoreland zoning ordinances, standards and restrictions.

313 255

NRC QUESTION 14b (NRC Letter dated May 15, 1979)

For mobile home parks in existance, please supply any publicly available information on police protection, fire protection, water supply and sewage facilities and degree to which expansion of the park can be accommodated within each of those social services. (4.1-3)

RESPONSE:

Name	Police Protection	Fire Protection	Water Supply	Sewage Facilities
1. Cleveland Heights Mobile Home Park	Village of Cleveland	Village of Cleveland	Village of Cleveland	Village of Cleveland
2. Bain's Incorporated	Sheboygan Cty. Sheriffs Dept.	Town of Sheboy. Fls.	Private Wells	Private treatment plant
3. Forest Ave. Mobile Home Park	City of Sheboy. Fls.	City of Sheboy. Fls.	City of Sheboy. Fls.	City of Sheboy. Fls.
4. Indian Meadows Mobile Home Subdiv.	City of Sheboygan	City of Sheboygan	City of Sheboygan	City of Sheboygan
5. Sommers Mobile Homes, Inc.	Town of Wilson & Sheboygan Cty. Sheriffs Dept.	Town of Wilson	Private Wells	Ind. Septic Systems & Combined Septic Systems

Four of the existing mobile home parks, Cleveland Heights, Bain's Incorporated, Forest Avenue and Sommers Mobile Homes, indicated they have no plans for expansion. However, Bain's Incorporated has undeveloped capacity for 9 additional spaces. The Indian Meadows Mobile Home Subdivision has an additional 42 acres established for future expansion. Plans for a recreation center to serve the subdivision and 50 additional spaces have been developed for several years, but have not as yet been implemented. There does not appear to be any restriction on the expansion which is planned due to limitation of the social services listed.

313 256

NRC QUESTION 14c (NRC Letter dated May 15, 1979)

What are the 1978 vacancy rates for the towns listed on page 8.2-3, and for other towns within 10 miles of the site. Please use the same columns as on page 8.2-3, and add a column for motels if those numbers are available.

RESPONSE:

The 1978 vacancy rates for the nine counties listed on page 8.2-3 of the Environmental Report are as follows:

Counties	Available Units	Vacant Units for Sale	Vacant Units for Rent	Vacant Units Available	Vacancy Rate
Milwaukee	365,597	1,985	7,321	9,306	2.58%
Ozaukee	21,416	150	138	288	1.36%
Washington	25,019	145	250	395	1.60%
Sheboygan	34,863	180	330	510	1.48%
Manitowoc	28,309	123	261	384	1.38%
Fond du Lac	28,623	155	238	393	1.40%
Outagamie	40,088	180	405	585	1.44%
Winnebago	46,273	348	511	859	1.88%
Brown	57,199	273	800	1,073	1.90%

Information on motels is not available

Source: Wisconsin Department of Local Affairs and Development. Housing Information System. Madison, Wisconsin. 1979.

313 257

NRC QUESTION 14d (NRC Letter dated May 15, 1979)

Define "vacant units for rent" on page 8.2-3.

RESPONSE:

"Vacant units for rent" are unoccupied units that are for rent and available to the general public.

313 258

NRC QUESTION 15 (NRC Letter dated May 15, 1979)

For the last 5 power plants constructed and starting with the plant most recently completed, please fill in the blanks. (4.1-10)

RESPONSE

The response to this question is provided in the attached table.

313 259

Name of Plant	Year Construction Completed	Location	MWE (Coal or Nuclear)	Peak Construction Force	Number of Construction Workers who Temporarily Relocated near the plant	Household Size relocating with Worker
1. Germantown	1978	Germantown, Wisconsin (Washington County)	213 Combustion Turbines	95 est.	N.A.	N.A.
2. Columbia	1978	Portage, Wisconsin (Columbia County)	1054 Coal	580	*	N.A.
3. Kewaunee	1973	Town of Carlton, Wisconsin (Kewaunee County)	535 Nuclear	755**	N.A.	N.A.
4. Point Beach	1972	Town of Two Rivers, Wisconsin (Manitowoc County)	994 Nuclear	900 est.	N.A.	N.A.
5. Valley	1969	Milwaukee, Wisconsin (Milwaukee County)	270 Coal	450 est.	N.A.	N.A.

* Approximately 36% of workforce was non-resident and either commuted over 50 miles to and from site on a daily basis or temporarily relocated.

** Construction Trade workers only, data for construction management personnel not available.

N.A. Information not available

313 260

NRC QUESTION 16 (NRC Letter dated May 15, 1979)

For Section 5.9.4, please give a short description of how costs were estimated.

RESPONSE

Decommissioning costs were estimated in the range of 5 to 100 million dollars based on order of magnitude estimates for the different decommissioning alternatives considered in Section 5.9.4 of the Environmental Report. These order of magnitude estimates have been validated in a detailed technical evaluation of decommissioning methods prepared by Battelle Northwest Laboratories for the NRC and titled "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station" NUREG/CR-0130, June 1978.

313 261

NRC QUESTION 17 (NRC Letter dated May 15, 1979)

In Table 8.1-3, break down the taxes 1977-1985 into amount collected by taxing district each year.

RESPONSE

The table below lists the estimated annual distribution of Ad Valorem taxes for a single unit at Haven for the years 1982 through 1985. The cumulative totals in this period are shown on Table S.8.1-3 of the Environmental Report. Tax rate used in calculations is 22.5 mills.

Haven Nuclear Plant
Estimated Annual Distribution of Ad Valorem Taxes*
(Dist. Under Sec. 79.04(3)

	1982	1983	1984	1985	1982-1985
Mosel Town	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 400,000
Sheboygan County	100,000	100,000	100,000	100,000	400,000
State General Revenue	4,687 ,95	7,730,425	11,809,105	17,222,475	41,450,000
Total	4,887,995	7,930,425	12,009,105	17,422,475	42,250,000

* All pre-construction Ad Valorem taxes are assumed to be paid during first four years of construction.

313 262

NRC QUESTION 18 (NRC Letter dated May 15, 1979)

Does the staff understand correctly that a description of the transmission lines is forthcoming which will supply information on its: (1) cost, (2) land use impact, (3) archaeological survey of the same quality as that for the Haven site itself?

RESPONSE

A description of proposed and alternative transmission facilities is provided in the Single Unit Supplement, Section S.3.9 and S.10.9. Costs of the proposed transmission facilities are provided in Table S.11.1-1.

Archaeological surveys of transmission line routes have not been performed. As stated in Sections 2.3.3 and 4.2.1.3 of the Environmental Report, items of historical or archaeological value which are found during transmission line construction will be reported to the State Historical Society. Known archeological sites are described in Section 2.3.3.2.

313 263

NRC QUESTION 19 (NRC Letter dated May 15, 1979

Describe the measures that will be taken to guarantee that the drift rate of 0.002 percent is both met and maintained. (Page 3.6-13)

RESPONSE:

Tower performance, including drift rate, would be verified prior to commercial operation in accordance with the requirements of ASME PTC-23, Atmospheric Water-Cooling Towers. During the operation of the Haven plant, routine periodic tower maintenance would be performed to ensure continued satisfactory tower performance.

313 264

NRC QUESTION 20 (NRC Letter dated May 15, 1979)

Provide information on the validation of the cooling tower drift model to show that the model does in fact accurately predict drift deposition values. (Section 3.6.3.1)

RESPONSE:

In order to validate a cooling tower drift model, a long-term field study is required. Such a study would involve careful monitoring of cooling tower emissions and ambient meteorological parameters, collection of deposition data from an array of samplers placed around the tower at various downwind distances, and separation of the contribution of the cooling tower deposition amounts from background levels over a wide range of meteorological conditions. A comprehensive experiment of this type is presently underway in California[1], but results are not available at this time for comparison with model predictions. However, short-term measurements of cooling tower drift deposition are available for model-data comparisons.

The most comprehensive field study to date on drift emissions, deposition rates, and environmental effects has been the Chalk Point Cooling Tower Project[2]. In the initial phases of the project, measurements were taken at the top of the natural draft tower to characterize the drift leaving the tower and air samples and deposition samples were taken at various downwind distances from the tower. Policastro et al[3] made use of these data along with data collected by Overcamp, Israel, and Pringle[4] in an attempt to validate the performance of several drift models. However, the results were inconclusive, showing inconsistent behavior by the models tested. This inconsistency could be attributed to inaccuracies in the field data and the inability to differentiate between background levels and those contributed by the cooling tower.

In order to separate cooling tower drift deposition amounts from background levels, Meyer and Stanbro[5] conducted a study in which the cooling tower drift was isolated from other sources by the use of a water soluble fluorescent dye in the cooling water as a tracer. Cooling tower emissions characteristics and operating parameters as well as ambient meteorological conditions were carefully monitored throughout the 4 hour experiment. Sampling arrays were placed downwind of the tower along 30 deg arcs at distances of 0.5 and 1.0 km to collect deposition data. By measuring dye concentrations in the samples collected, cooling tower deposition rates were determined.

Using the data described above[5], the performance of the Stone & Webster Engineering Corporation (S&W) salt drift model was tested by comparing the model predictions of deposition rate with the measured values. The results of this comparison are summarized in the attached table. They indicate that the model predictions are in good agreement with the measured values. The model overpredicted the average deposition rate at the 0.5 km distance by a factor of 1.65 and by a factor of 1.5 at the 1.0 km distance. It also predicts the rate of decrease of deposition rate with downwind distance very well as evidenced by the ratio of the 0.5 km deposition rate to the 1.0 km value.

The performance of the model in this test appears to be representative of the present state-of-the-art of cooling tower drift modeling when compared with the performance of other models. In an analysis conducted by Davis and Moon[6], two other models were tested with the dye tracer data and their predictions were found to be in error by factors ranging from 1.2 to 1.7.

In summary, the lack of long-term field data prevents the actual validation of the S&W salt drift model or any other model. However, based on a limited amount of field data, the model does demonstrate the capability of producing reasonably accurate predictions of salt deposition which are representative of the present state-of-the-art.

REFERENCES:

1. Laulainen, N. S. Experimental Design For a Case Study of Drift From a Mechanical Draft Cooling Tower. Cooling Tower Environment - 1978 Proceedings, May 2-4, 1978.

2. Piel, J., The Chalk Point Cooling Tower Project Cooling Tower Environment - 1974 Proceedings, March 4-6, 1974.

3. Policastrao, A. J.; Carhart, R. A.; Dunn, W. E.; Shobrys D.; Ratcliff, M.; Cooper, K.; and Devantier, B. Validation of Cooling Tower Plume Rise and Salt Drift Deposition Model - Progress Report. Division of Environmental Impact Studies, Argonne National Laboratory, 1977.

4. Overcamp, T. J.; Israel, G. W.; and Pringle, W. J. B. Drift Droplet Deposition Measurements From a Brackish Water Natural Draft Cooling Tower. Sponsored by the State of Maryland Power Plant Siting Program - Chalk Point Cooling Tower Project, 1976.

5. Myer, J. H. and Stanbro, W. D. Separation of Chalk Point Drift Sources Using a Fluorescent Dye. Cooling Tower Environment - 1978 Proceedings, May 2-4, 1978.

6. Davis, E. A. and Moon, M. L. Modeling Analysis of the Chalk Point Dye Tracer Experiment. Cooling Tower Environment - 1978 Proceedings, May 2-4, 1978.

313 267

PREDICTED VERSUS OBSERVED DEPOSITION RATES FOR
THE CHALK POINT DYE TRACER EXPERIMENT

Downwind Distance	Deposition Rates (averaged over 35 deg arc) Predicted[1]	Observed[2]	Percent Error
(m)	($kg/km^2 \cdot mo$)	($kg/km^2 \cdot mo$)	
500	4,881	2,966	65%
1,000	1,282	854	50%
500/1,000	3.8 (Ratio)	3.3 (Ratio)	

[1] S&W model prediction.

[2] Meyer, et al, 1978.

313 268

NRC QUESTION 21 (NRC Letter dated May 15, 1978)

Provide information on the validation of the cooling tower plume model to show that the model does in fact accurately simulate nature (the limited validation information in Reference 17 does not do this). (P. 5.1-18)

RESPONSE:

The Stone & Webster Engineering Corporation (S&W) visible plume model was one of eight models tested in a study[1] conducted by Argonne National Laboratory in which the predictions of each model were compared with field data from five sites. In comparison to the other seven models, the S&W model ranked second in the representation of plume height predictions and third in plume length predictions. It was found to have the best absolute log mean ratio of predicted value to observed value but missed three of the cases by more than a factor of five in which it generally overpredicted length and underpredicted height. Overall, the plumes were characterized as generally long with a slight tendency to overpredict height. In 8 of the 11 cases, the model gave meaningful values of plume height.

As a result of this study, it can be concluded that the model does provide reasonably accurate simulations of nature and that when the model is in error, it is generally a conservative error in that it has a tendency to overpredict plume length.

REFERENCE:

1. Policastro, A. J.; Carhart, R. A.; and DeVantier, B. Validation of Selected Mathematical Models for Plume Dispersion From Natural Draft Cooling Towers. Presented at the Waste Heat Management and Utilization Conference, Miami Beach, May 9-11, 1977.

313 269

NRC QUESTION 22 (NRC Letter dated May 15, 1979)

Compare the predicted salt deposition values due to drift with natural deposition due to dry fallout and rain out.

RESPONSE:

There are numerous studies available in which the chemical composition of rainwater has been determined by field measurements over a long period, so that natural deposition amounts due to rain out can be determined. One of these studies (Junge et al, 1958)[1] provides measurements of rainwater concentrations of various ions at Madison, Wisconsin, which is approximately 90 mi from the Haven site. This study sought to determine the concentration of chloride (Cl^{-}), sodium (NA^{+}), potassium (K^{+}), and calcium (CA^{++}) ions, as well as sulfate concentrations at 62 locations across the United States. The data gathered at Madison, Wisconsin, were utilized to determine the natural deposition amounts due to rainwater in the Haven area.

Based on an annual average rainfall amount of 30 in./yr at Madison[2], the annual average concentrations reported by Junge at Madison were converted to annual deposition amounts. Table 1 presents the results of this calculation, indicating the concentration of each ion in the rainwater and the corresponding deposition rate. A comparison of these values with the maximum annual deposition rate predicted for the cooling tower (0.46 lb/acre/yr), which includes all solids dissolved in the circulating water, indicates that the cooling tower contribution is very small compared to ambient levels, not considering dry deposition.

313 270

Information on dry deposition could not be obtained.

REFERENCES:

1. Junge, C. E. and Werby, R. T. The Concentration of Chloride, Sodium, Potassium, Calcium, and Sulfate in Rainwater Over the United States. Journal of Meteorology, Vol. 15, No. 5, October 1958.

2. Local Climatological Data, Madison, Wisconsin, National Climatic Center, Ashville, North Carolina, 1976.

313 271

COMPARISON OF PREDICTED COOLING TOWER DEPOSITION RATES WITH NATURAL DEPOSITION AMOUNTS DUE TO RAIN OUT

Constituent	Average Concentration in Rainwater (ppm)[1]	Annual Deposition Amount (lb/acre/yr)[2]
Cl^-	0.19	1.3
Na^+	0.49	3.3
K^+	0.22	1.5
Ca^{++}	1.24	8.4
Total natural deposition	2.14	14.5
Cooling Tower Deposition	(Maximum Annual)	0.46

1 Based on 1 yr of measurements at Madison, Wisconsin.

2 Based on annual average precipitation of 30 in. at Madison, Wisconsin.

313 272

NRC QUESTION 23 (NRC Letter dated May 15, 1979)

State the value of the drag coefficient (C_d) used in the calculations. (P. 5.1-19)

RESPONSE

The value of the drag coefficient (C_d) that was utilized in the calculation presented in Section 5.1.5 is 1.5. This value was determined empirically by Stone & Webster Engineering Corporation using the observational data reported in Reference 17, Section 5.1.5 of the Environmental Report.

313 273

NRC QUESTION 24 (NRC Letter dated May 15, 1979)

Describe how aerodynamic downwash is included in the model for cooling tower plumes.

RESPONSE:

The effect of a tower-induced pressure region on the downwind side of the cooling tower mouth is accounted for in the model as described in Section 5.1.5.1 of the Environmental Report (ER). The result of this effect is to drag the plume below the tower mouth in the initial phase of the plume trajectory and retard the plume rise somewhat under high wind speed conditions, as illustrated in ER Figures 5.1-6 through 5.1-13.

The treatment of aerodynamic downwash for mechanical draft cooling tower plumes is discussed in the Response to Question 27.

313 274

NRC QUESTION 25 (NRC Letter datec May 15, 1979)

Cooling tower plumes higher than 1,500 ft and longer than 1 mi do occur frequenty. Indicate the frequency, direction, length, and plume height of such plumes.

RESPONSE:

In order to predict the frequency, length, and height of plumes that extend beyond the range of the grid presented in Figures 5.1-6 through 5.1-13, the visible plume model described in Section 5.1.5 was rerun using the same input data as described in Section 5.1.5 but with an expanded grid. The revised grid spacing was extended to 3,000 ft in the vertical dimension and to 7,500 ft in the downwind direction. This captured the full extent of all plumes except for those occurring less than 0.5 percent of the time in each downwind sector. Table 1 summarizes the visible plume frequencies, lengths, and heights for those plumes that extended beyond the original grid size.

313 275

VISIBLE PLUME FREQUENCIES AND EXTENTS BEYOND
1,500 FT IN HEIGHT AND 5,000 FT DOWNWIND

Frequency	Downwind Direction	Height (ft)	Length (ft)
1%	N	2,800	2,700
	NNE	2,200	2,400
	NE	1,800	2,400
	ENE	2,000	2,400
	E	2,000	3,300
	ESE	2,400	4,500
	SE	2,400	4,200
	SSE	2,400	4,500
	S	2,500	4,500
	SSW	2,000	3,900
	SW	1,700	3,600
	WSW	1,600	4,000
	W	1,700	3,500
	WNW	1,700	3,300
	NW	1,800	3,000
	NNW	1,800	2,700
0.3%	N	>3,000	4,500
	NNE	>3,000	4,800
	NE	>3,000	3,900
	ENE	>3,000	4,200
	E	>3,000	5,100
	ESE	>3,000	5,700
	SE	>3,000	5,700
	SSE	>3,000	6,600
	S	>3,000	6,900
	SSW	>3,000	6,900
	SW	>3,000	6,900
	WSW	>3,000	6,200
	W	>3,000	7,200
	WNW	>3,000	5,700
	NW	>3,000	4,500
	NNW	>3,000	4,500
0.1%	N	>3,000	>7,500
	NNE	>3,000	6,300
	NE	>3,000	7,200
	ENE	>3,000	5,700
	E	>3,000	6,300
	ESE	>3,000	>7,500
	SE	>3,000	>7,500
	SSE	>3,000	>7,500
	S	>3,000	>7,500
	SSW	>3,000	>7,500
	SW	>3,000	>7,500
	WSW	>3,000	>7,500
	W	>3,000	>7,500
	WNW	>3,000	>7,500
	NW	>3,000	6,300
	NNW	>3,000	6,600

313 276

NRC QUESTION 26 (NRC Letter dated May 15, 1979)

Justify the fai'ure to consider round mechanical draft and fan-assisted cooling towers in your analyses. (Section 10.1)

RESPONSE:

Updated comparisons of Alternative Closed Cycle Cooling Systems were provided in Section 10.1 of Amendment 12 to the Environmental Report (ER) and which includes round mechanical draft cooling towers. Fan-assisted natural draft cooling towers (FANDT) were not included for the reasons provided in the response to NRC Question III 500.28, Part (4), Amendment 12 of the ER.

313 277

NRC QUESTION 27 (NRC Letter dated May 15, 1979)

Describe how aerodynamic downwash is included in the model for linear mechanical draft cooling tower plumes. Describe how this feature of a model has been validated. (p. 10.1-9)

RESPONSE:

The mechanism of aerodynamic downwash and its effect on mechanical draft cooling tower plumes is extremely complex in nature. In order to properly account for these effects in a model, it would be necessary to conduct wind tunnel studies for the specific tower geometry and plant design in question and carefully study the effects of various wind speeds and directions on the emitted plumes. Since this approach is not always practical, a conservative approach has been taken in which the plume trajectories predicted by the model for linear mechanical draft towers are lowered by 150 ft which is approximately twice the height of the towers. The effect of this adjustment is to substantially increase the frequency and horizontal extent of ground level fogging occurrences.

This adjustment factor is based on a review of the theory and assumptions incorporated into the model, research on the aerodynamics around a cooling tower, and comparisons of model predictions with observations of mechanical draft cooling tower plumes. Therefore, the downwash treatment utilized in this analysis has been validated to the extent that the adjusted plume trajectories have been compared to observations and found to conservatively account for the effects of downwash on ground level fogging occurrences.

313 278

NRC QUESTION 28 (NRC Letter dated May 15, 1979)

Indicate the change in expected hours of fogging due to the use of one, instead of two, power plants. (Figures 10.1-2 and 10.1-5)

RESPONSE:

Fogging analyses were performed for the rectangular mechanical draft three-tower arrangement and for the round mechanical draft two-tower field. The input data for the computer runs were the same as used previously for the two-unit analyses except for the number of towers considered. The results of these analyses are contained in Sheet 1 of the attached table for the rectangular towers and Sheet 2 for the round towers. In these tables, the downwind distances of the 5 percent, 3 percent, and 1 percent ground fog occurrence frequencies are given for each 45 deg sector for the single unit plant. For comparison, the previous two-unit frequencies are also provided.

313 279

CHANGE IN EXPECTED HOURS OF FOGGING DUE TO ONE UNIT OPERATION - RECTANGULAR MECHANICAL DRAFT COOLING TOWERS

Occurrence Frequency	Downwind Sectors	Distance (ft) Two Units	Distance (ft) Single Unit	Ratio of Distance Two Units/Single Unit
5%	N, NNE	1,100	1,000	1.1
	NE, ENE	1,200	1,000	1.2
	E, ESE	1,300	1,200	1.1
	SE, SSE	1,400	1,400	1.0
	S, SSW	1,400	1,400	1.0
	SW, WSW	1,000	1,000	1.0
	W, WNW	300	200	1.5
	NW, NNW	1,100	1,000	1.1
3%	N, NNE	1,300	1,200	1.1
	NE, ENE	1,500	1,400	1.1
	E, ESE	1,400	1,500	0.9
	SE, SSE	1,500	1,600	0.9
	S, SSW	1,500	1,600	0.9
	SW, WSW	1,400	1,200	1.2
	W, WNW	1,100	900	1.2
	NW, NNW	1,300	1,100	1.2
1%	N, NNE	1,500	1,300	1.2
	NE, ENE	1,700	1,700	1.0
	E, ESE	1,700	2,000	0.9
	SE, SSE	1,800	2,[illegible]00	0.9
	S, SSW	2,100	2,400	0.9
	SW, WSW	1,700	1,400	1.2
	W, WNW	1,400	1,200	1.2
	NW, NNW	1,700	1,500	1.1

313 280

CHANGE IN EXPECTED HOURS OF FOGGING DUE TO ONE UNIT OPERATION - ROUND MECHANICAL DRAFT COOLING TOWERS

Occurrence Frequency	Downwind Sectors	Distance (ft) Two Units	Distance (ft) Single Unit	Ratio of Distance Two Units/Single Unit
5%	N, NNE	900	900	1.0
	NE, ENE	1,000	900	1.1
	E, ESE	1,100	1,000	1.1
	SE, SSE	1,000	1,000	1.0
	S, SSW	1,000	1,100	0.9
	SW, WSW	800	900	0.9
	W, WNW	200	200	1.0
	NW, NNW	900	800	1.1
3%	N, NNE	1,000	1,000	1.0
	NE, ENE	1,200	1,100	1.1
	E, ESE	1,200	1,100	1.1
	SE, SSE	1,100	1,100	1.0
	S, SSW	1,200	1,100	1.1
	SW, WSW	1,100	1,100	1.0
	W, WNW	800	900	0.9
	NW, NNW	1,000	1,000	1.0
1%	N, NNE	1,200	1,200	1.0
	NE, ENE	1,400	1,400	1.0
	E, ESE	1,300	1,400	0.9
	SE, SSE	1,400	1,300	1.1
	S, SSW	1,600	1,600	1.0
	SW, WSW	1,400	1,500	0.9
	W, WNW	1,200	1,100	1.1
	NW, NNW	1,400	1,400	1.0

313 281

NRC QUESTION 29 (NRC Letter dated May 15, 1979)

Indicate the expected hours of fog per year expected over Highways 141, 42 and I-43, and County LS due to the operation of one power plant with mechanical draft cooling towers (MDCTs).

RESPONSE:

Based on the results of the visible plume analyses performed for single unit rectangular and round MDCTs described in the response to Question 28, no ground-level fogging is expected to occur over Highways 141, 42, or I-43 due to the operation of the MDCTs. A limited amount of ground fog resulting from MDCT operation is expected over County LS, with a frequency of approximately 50 hours per year for the rectangular MDCTs and less than 10 hours per year for the round MDCTs. The greater buoyancy and rise of plumes from the round MDCTs accounts for the lower frequency of ground fog predicted for these towers.

313 282

NRC QUESTION 30 (NRC letter dated May 15, 1979)

Describe the model used to predict steam fog over the thermal plume in the lake. Indicate the validation procedures used. Are the data on steam fog over the lake at Point Beach and Kewaunee reactor sites consistent with the model predictions?

RESPONSE:

The discussion of design alternatives for once-through cooling systems presented in Section 10 of Amendment 9 was superseded in its entirety by Section 14 of Amendment 13.

As stated in Section 14.10.1.10 on Page 14.10-15, "the proposed cooling system for the Haven Nuclear Plant is a once-through cooling system with an offshore multiport diffuser." The shoreline discharge is no longer considered as one of the alternative discharge systems which are presented in Section 14.10.3.

Due to the small surface area of the thermal plume associated with a diffuser discharge (3°F isotherm, about 5.3 acres), the extent of steam fog over the thermal plume is negligible and a detailed modeling analysis is considered not necessary.

313 283

NRC QUESTION 31 (NRC Letter dated May 15, 1979)

Provide monthly values of evaporation and blowdown for extreme meteorological conditions.

RESPONSE:

The attached table (Sheet 1) shows evaporation and blowdown values at the natural draft cooling tower during occurrence of the extreme wet bulb temperature. Tower evaporation is a function of both wet bulb temperature and relative humidity and, therefore, the values of evaporation and blowdown may not be extreme. Maximum tower evaporation, and minimum blowdown, occur during the maximum wet bulb temperature and minimum relative humidity, whereas minimum tower evaporation, and maximum blowdown, occur during minimum wet bulb and maximum relative humidity. These values have been assumed to occur simultaneously to determine the extreme boundaries of tower evaporation and blowdown. The resulting tower characteristics are shown on Sheet 2 of the attached table.

313 284

COOLING TOWER CHARACTERISTICS DURING OCCURRENCE OF EXTREME WET BULB TEMPERATURES

Month	Maximum Wet Bulb[1] (°F)	Relative Humidity[2] (%)	Evaporation (gpm)	Blowdown[3] (gpm)	Minimum Wet Bulb[1] (°F)	Relative Humidity[2] (%)	Evaporation (gpm)	Blowdown[3] (gpm)
Jan	34.2	77.0	8,350	8,450	-8.1	56.2	3,850	12,950
Feb	34.5	82.5	8,250	8,550	3.6	66.3	5,400	11,400
Mar	43.0	68.3	9,200	7,600	7.6	71.0	5,400	11,400
Apr	54.8	82.3	9,850	6,950	29.4	60.0	8,150	8,650
May	66.2	70.0	11,000	5,800	37.2	77.5	8,600	8,200
Jun	70.2	78.0	11,100	5,700	52.1	75.2	9,800	7,000
Jul	74.0	75.3	11,450	5,350	57.4	69.6	10,300	6,500
Aug	73.7	79.2	11,400	5,400	54.4	66.7	10,100	6,700
Sep	73.1	83.4	11,150	5,650	44.6	63.4	9,450	7,350
Oct	60.4	79.5	10,300	6,500	33.4	59.7	8,500	8,300
Nov	50.6	90.7	9,400	7,400	17.3	66.0	6,900	9,900
Dec	34.5	80.6	8,200	8,600	-2.9	71.2	4,550	12,250

[1] 7-day average

[2] During extreme wet bulb temperature occurrence

[3] Based on 16,800 gpm makeup flow

NOTE: Meteorological data from General Mitchell Field, Milwaukee, 1955-64

313 285

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COOLING TOWER CHARACTERISTICS DURING SIMULTANEOUS OCCURRENCE OF EXTREME WET BULB TEMPERATURE AND EXTREME RELATIVE HUMIDITY

Month	Maximum Wet Bulb[1] (°F)	Minimum Rel. Hum.[2] (%)	Evaporation (gpm)	Blowdown[3] (gpm)	Minimum Wet Bulb[1] (°F)	Maximum Rel. Hum.[4] (%)	Evaporation (gpm)	Blowdown[3] (gpm)
Jan	34.2	54.1	8,700	8,100	-8.1	90.1	3,850	12,850
Feb	34.5	47.5	8,800	8,000	3.6	89.[illegible]	5,400	11,400
Mar	43.0	57.2	9,500	7,300	7.6	93.5	5,400	11,400
Apr	54.8	47.7	10,700	6,100	29.4	85.8	7,800	9,000
May	66.2	43.1	11,800	5,000	37.2	88.9	8,350	8,450
Jun	70.[illegible]	55.5	11,800	5,000	52.1	91.8	9,450	7,350
Jul	74.0	55.6	12,050	4,750	57.4	83.6	9,950	6,850
Aug	73.7	58.3	12,000	4,800	54.4	91.1	9,650	7,150
Sep	73.1	52.5	12,100	4,700	44.6	89.5	9,000	7,800
Oct	60.4	53.3	11,000	5,800	33.4	93.5	8,000	8,800
Nov	50.6	61.5	9,950	6,850	17.3	90.7	6,700	10,100
Dec	34.5	59.6	8,600	8,200	-2.9	93.1	4,550	12,250

[1] 7-day average

[2] Minimum recorded 7-day relative humidity for month

[3] Based on 16,800 gpm makeup flow

[4] Maximum recorded 7-day average relative humidity for month

NOTE: Meteorological data from General Mitchell Field, Milwaukee, 1955-64

NRC QUESTION 32 (NRC Letter dated May 15, 1979)

Provide monthly maximum, average-maximum, average, average-minimum, and minimum water temperatures of Lake Michigan, preferably in the shore region, 0-30 ft.

RESPONSE:

Water temperature data used for analyses at the Haven site were collected from the Sheboygan Water District. Water temperature is measured daily from intakes located at the 45-ft. and 25-ft. depth contours in Lake Michigan, and is applicable to the Haven site. The data period used for analysis is 1932-1975 inclusive. The mean water temperature during this period was 44°F, with extreme water temperatures of 74°F and 32°F. Table 1 lists the requested values.

TABLE 1

WATER TEMPERATURE AT SHEBOYGAN, WISCONSIN

Month	Maximum Daily (°F)	Average Maximum Daily (°F)	Average Daily (°F)	Average Minimum Daily (°F)	Minimum Daily (°F)
Jan	38	35	35	33	32
Feb	38	35	34	33	32
Mar	42	37	35	33	32
Apr	47	43	40	36	32
May	54	48	45	42	38
Jun	60	53	46	43	4[illegible]
Jul	71	62	52	43	4[illegible]
Aug	74	66	57	44	41
Sep	71	63	55	45	42
Oct	61	55	50	44	41
Nov	56	47	45	39	34
Dec	45	40	38	34	32

313 287

NRC QUESTION 33 (NRC Letter dated May 15, 1979)

The maximum concentration factor has a probability of being exceeded 0.03 percent of the time. To what extent is the maximum concentration factor exceeded? (Section 3.6.1.3)

RESPONSE:

The maximum concentration factor of 3.3 would occur at a tower evaporation rate of about 11,700 gpm. To determine the extent of exceeding the maximum concentration factor, a review was conducted of simultaneously-occurring relative humidity and wet bulb data from General Mitchell Field, Milwaukee, for the period 1955-1964. Based on 7-day average values, there is no occurrence of an evaporation rate of 11,700 gpm or greater. The maximum concentration factor would not have been exceeded if the tower had been operating during this period.

Using a combination of worst-case wet bulb temperature and humidity recorded during the period 1955-1964, the worst-case concentration factor would be 3.9.

313 288

NRC Question 34(NRC Letter dated May 15, 1979)

Collected oil is trucked offsite for disposal. Where is this site and who owns it? (Section 3.6.1.4)

RESPONSE

Contractual arrangements with licensed disposal contractors will be made at the time plant operation begins.

313 289

NRC Question 35 (NRC Letter dated May 15, 1979)

Is blowdown discontinued during the period where hypochlorite is injected into the circulating water system? This practice could minimize residual chlorine levels in the cooling blowdown. (Section 3.6.4)

RESPONSE

Discontinuing blowdown during chlorination periods is not planned or necessary to maintain chlorine levels in the cooling tower blowdown to acceptable levels. As stated in Section 3.6.4, State of Wisconsin and EPA regulations will be met at all times with the procedure described.

313 290

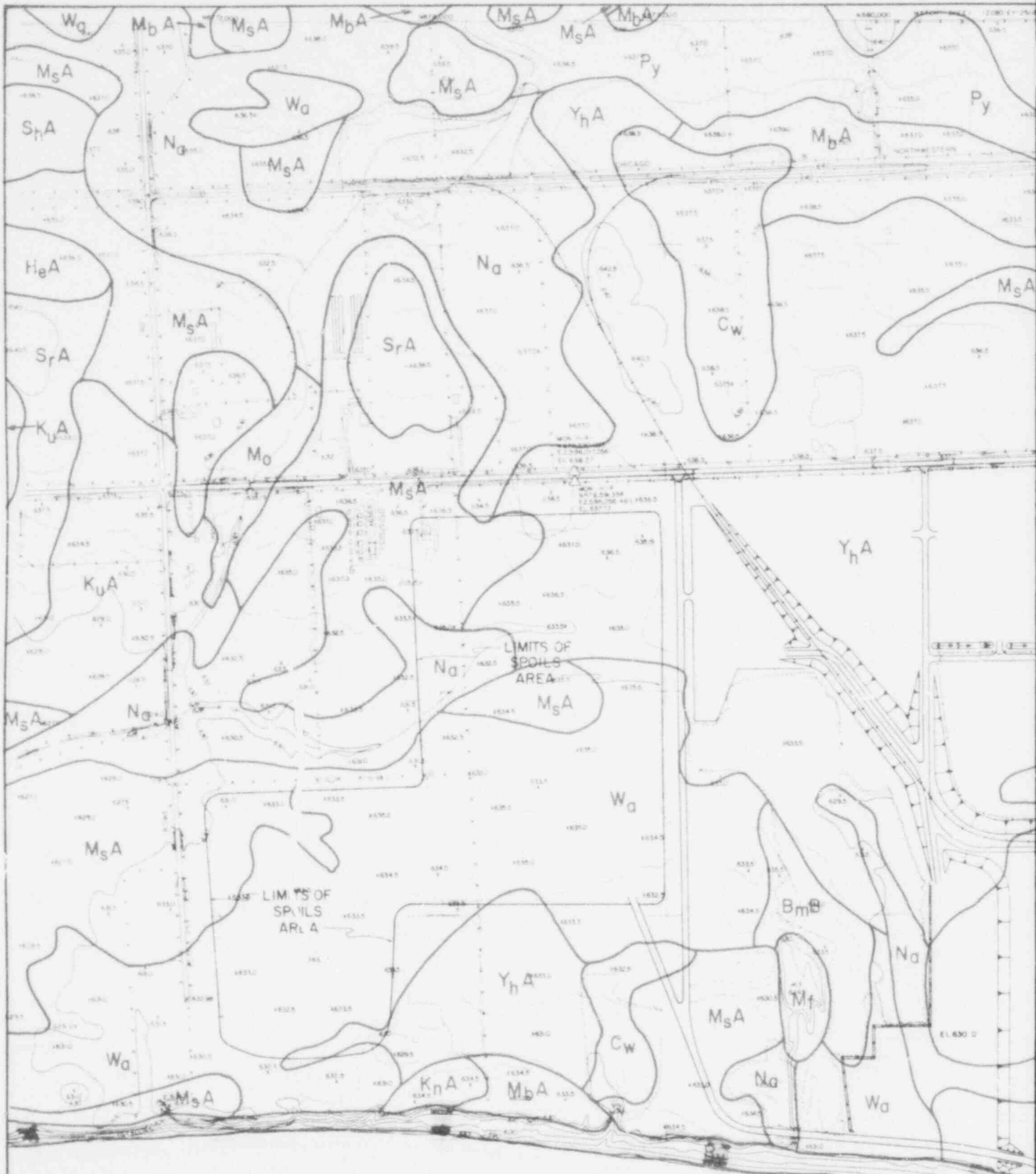
NRC QUESTION 36 (NRC Letter dated May 15, 1979)

Provide a site map showing soil types accompanied by a description of the mapping units.

RESPONSE:

Figure 36-1 is a site map showing soil types, and Table 36-1 provides a description of the mapping units.

313 291



NOTES:

1. COORDINATES ARE BASED ON WISCONSIN STATE COORDINATE SYSTEM, SOUTH ZONE
2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL DATUM
3. TOPOGRAPHY BASED ON AERIAL SURVEY BY CHICAGO AERIAL SURVEY
4. REFER TO TABLE 36-1 FOR DESCRIPTION OF SOILS TYPE

REF: SOIL SURVEY OF SHEBOYGAN COUNTY, WISCONSIN, U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SURVEY, JAN 1978

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FIGURE 36-1
SITE AREA SOIL TYPES
WISCONSIN UTILITIES PROJECT
HAVEN NUCLEAR PLANT

TABLE 36-1

SOIL TYPE DESCRIPTIONS*

Symbol	Name	Description
BmB	Boyer loamy sand 2 to 6 percent slopes	Gently sloping well drained soil on outwash plains along major streams. Underlain by stratified sand and gravel.
C_w	Colwood silt loam	Nearly level poorly drained soil in depressions in old glacial lake plains. Underlain by stratified silt and very fine sand.
C_y	Cut and fill land, loamy	Cut and filled silt loam, loam, clay loam, sandy loam, or sandy clay loam. Slopes are 0 to 6 percent. Many of the filled areas are underlain by a poorly drained soil. Most cut areas are in glacial till, but some are in lacustrine basins.
H_eA	Hebron loam, 0 to 2 percent slopes	Nearly level moderately well drained soil formed in thin layer of loamy material on old glacial lake plains and in depressions in till plains. Formed on stratified silty and clayey lacustrine deposits.
K_nA	Kewaunee silt loam, 0 to 2 percent slopes	Nearly level moderately well drained soil on till plains. Formed in silty clay loam glacial till.
K_nB	Kewaunee silt loam, 2 to 6 percent slopes	Gently sloping well drained soil on till plains. Formed in silty clay loam glacial till.
K_uA	Kibbie silt loam, 0 to 3 percent slopes	Nearly level and gently sloping somewhat poorly drained soil in depressions in old glacial lake plains. Underlain by stratified silt and very fine sand.

313 294

* Reference: Soil Survey of Sheboygan County, Wisconsin, U.S. Department of Agriculture, Soil Conservation Survey, January 1978.

TABLE 36-1 (Cont'd)

Symbol	Name	Description
M_bA	Manawa silt loam, 0 to 3 percent slopes	Nearly level and gently sloping somewhat poorly drained soil in drainage ways and slight depressions. Formed on till plains and old glacial lake basins.
M_f	Marsh	Very poorly drained mixed mineral and organic material that is covered with water most of the year. It borders on lakes and streams and is in potholes in moraines and outwash plains. Slopes are 0 to 2 percent.
M_o	Montgomery silty clay loam	Nearly level very poorly drained soil in drainage ways and drainage basins. Formed in old glacial lake basins and underlain by stratified clay, silt, and very fine sand.
M_sA	Mosel loam, 0 to 3 percent slopes	Nearly level and gently sloping somewhat poorly drained soil formed in loamy lacustrine deposits. In old glacial lake basins and in depressions on the plain.
Na	Navan loam	Nearly level poorly drained soil in drainage ways and drainage basins. Underlain by silty and clayey deposits. In old glacial lake basins and on till plains where water has deposited a thin layer of loamy material over the clayey material.
Py	Poygan silty clay loam	Nearly level poorly drained soil in drainage ways and drainage basins. Formed in silty clay loam and silty clay lacustrine deposits or glacial till.
Ry	Rough broken land	On lake banks, river banks, and escarpments. It is well drained. Slopes are 20 to 45 percent. This land is mostly reddish brown silty clay loam or clay loam glacial till.
S_hA	Saylesville silt load, 0 to 2 percent slopes	Nearly level, moderately well drained soil in old glacial lake basins and on terraces. Underlain by stratified silt loam and silty clay loam.

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TABLE 36-1 (Cont'd)

Symbol	Name	Description
S_rA	Sisson very fine sandy loam, 0 to 2 percent slopes	Nearly level, well drained soil in old glacial lake basins and on outwash plains. Underlain by stratified silt and very fine sand.
S_rB	Sisson very fine sandy loam, 2 to 6 percent slopes	Gently sloping, well drained soil in old glacial lake basins and on outwash plains. Underlain by stratified silt and very fine sand.
S_rC2	Sisson very fine sandly loam, 6 to 12 percent slopes	Sloping, well drained soil, on the sides of old glacial lake basins and on outwash plains. Underlain by stratified silt and very fine sand.
Wa	Wasepi sandy loam	Nearly level, somewhat poorly drained oil on old glacial lake plains and outwash plains. Formed in sandy and loamy deposits underlain by sandy glacial outwash.
W_bC2	Waymor silt loam, 4 to 12 percent slopes, eroded	Gently sloping and sloping, well drained soil on broad glacial till plains. Formed in this silty and loamy layer over calcareous loamy glacial till.
Y_hA	Yaraha very fine sandy loam, 0 to 3 percent slopes	Nearly level and gently sloping, somewhat poorly drained soil in old glacial lake basin. Underlain by lacustrine silt, very fine sand, and loam.

313 296

NRC QUESTION 37 (NRC Letter dated May 15, 1979)

Provide a table and/or figure which gives densities by species and depths for fish eggs and larvae through time at the Haven site. Include densities at the location and depth of the proposed intakes. (Section 5.1)

RESPONSE:

Answers to Question 37 and to any questions involving fish species inhabiting the Lake Michigan area near the proposed facility will consist of detailed information which has been prepared for the RIS (Representative Important Species) or CAO (Critical Aquatic Organisms) in the Applicants' 316(a) and 316(b) demonstrations, respectively. The rationale behind the selection of these species is presented in Section 4.2 of the 316(a) and Section 4.3 of the 316(b) documents which are provided under separate cover.

Densities of alewife and smelt larvae in the vicinity of the proposed intake facilities are presented in Tables B-16 and B-17, respectively, of Appendix B to the Applicant's 316(a) demonstration. Densities of alewife eggs are presented in Table B-15 of the same appendix. Eggs and larvae of lake whitefish, coho salmon, brown trout, lake trout, longnose dace and white sucker were not found in Lake Michigan near the proposed intakes nor in adjoining reference areas.

313 297

NRC QUESTION 38 (NRC Letter dated May 15, 1979)

Provide similar (as in 42 above) data for young and adult fishes. (Section 5.1)

RESPONSE:

Distribution of young and adult alewife, smelt, white sucker, longnose dace, lake trout and brown trout near the proposed site was determined using gill nets, trawls and seines during the baseline program. Figures B-1 through B-6 from Appendix B of the Applicants' 316(a) demonstration depict the distribution of these species. As only 6 lake whitefish and 20 coho salmon were caught during the baseline study, no distribution figures were prepared.

313 298

NRC QUESTION 39 (NRC Letter dated May 15, 1979)

Provide a discussion on the relative impingement vulnerability of Lake Michigan fishes at the Haven site. Include such factors as size, swimming speed, and spatial and temporal availability. (Section 5.1)

RESPONSE:

A discussion of the relative vulnerability of fish to impingement at the proposed intake locations is thoroughly addressed in Section 6.2 of the Applicants' 316(b) Demonstration.

313 299

NRC QUESTION 40 (NRC Letter dated May 15, 1979)

What effect will upwelling conditions have on potential impingement and entrainment. How often do upwelling conditions occur? (Section 5.1)

RESPONSE:

An in-situ monitoring program of ambient water temperature in the vicinity of the proposed facility was conducted for a 12 month period (November 1977 - October 1978). Thermographs were stationed at the 17 and 32 ft. depth contours near the proposed intake locations. Near surface and near bottom water column positions were monitored at each location. The results of these studies are discussed in section 2.5 of the Environmental Report.

The only fish species routinely influenced by the upwelling phenomenon are the lake trout, coho salmon and brown trout. These species frequent the near shore areas of western Lake Michigan during the spring, summer and autumn, or approximately during the period April through November. The Applicants' proposed intake structure, because of the low volume of water utilized will have little or no impact on these larger fish because of their ability to avoid the structure. Thus, upwellings will have minimal influence on potential impingement and entrainment.

313 300

NRC QUESTION 41 (NRC Letter dated May 15, 1979)

Provide a discussion of the seasonal vertical and horizontal dispersion of the thermal plume with respect to the nearshore shallow water biotic communities. (Section 5.1)

RESPONSE:

Seasonal variation in the horizontal dispersion of the thermal plume is discussed in Section 5.1.2. Because of the shallow nature of the water into which the heated effluent is discharged, and the rapid mixing which would occur throughout the water column, the surface isotherms on Figures 5.1-1, 5.1-2, and 5.1-3 can also be considered representative of the distribution of temperature throughout the water column (vertical dispersion).

The effect of the thermal plume on the nearshore biotic communities is discussed in Section 5.1.4 and the Single Unit Supplement, Table S.11.1-1A. Only a small portion (less than 15 acres throughout the year) of the aquatic habitat at the site would be affected by temperature fluctuations in excess of those which normally occur in nearshore areas of Lake Michigan. Effects, if any, would be limited to those organisms in the immediate vicinity of the discharge. The biota near the discharge are similar in all respects to those in the balance of the areas studied at the site. Therefore, there should be no overall effect on nearshore shallow water biotic communities at the site.

313 301

NRC QUESTION 42 (NRC Letter dated May 15, 1979)

In view of diurnal vertical migrations by zooplankton, were samples collected at night? Did density differences occur between day and night samples? (P. 11, App. I)

RESPONSE:

No zooplankton samples were collected at night during the baseline study. However, since multiple, vertical bottom to surface townet samples were collected, zooplankton present throughout the entire water column were adequately sampled.

313 302

NRC QUESTION 43 (NRC Letter dated May 15, 1979)

Provide the rationale for compositing phytoplankton samples from all depths.

RESPONSE:

Phytoplankton samples from all depths were composited to provide the investigators with an additional aid in characterizing the phytoplankton inhabiting the entire water column.

The phytoplankton samples were composited to provide the maximum amount of quantitative information of the species inhabiting the entire water column, while reducing the expense which would be required to analyse samples from various depths. This allowed the detailed description of the phytoplankton community and provided sufficient data for impact assessment.

313 303

NRC QUESTION 44 (NRC Letter dated May 15, 1979)

To what depth into the sediment were benthos samples collected with the pumping technique. (P. 17, App. I)

RESPONSE:

Diver-assisted pump samples were collected bimonthly at 20 Lake Michigan locations to characterize the benthic organism community. The major types of substrate encountered were clay/silt, sand, gravel and rocks. Material covering rocks was totally removed by the diver. Periphytic growth on rocks varied in thickness as a function of season and thus the amount of material collected varied by month from this substrate. All loose surface material was recovered from the sand and clay substrates. Smaller gravel sizes were recovered with the sample, however, the areas on and around the coarser gravel were brushed off or stirred by the diver as the suction hose was in place. In general, while few samples deeper than a few centimeters could be collected from the existing substrates, the benthic community was adequately sampled. Since most benthic organisms are found in these upper portions of the sediments.

313 304

NRC QUESTION 45 (NRC Letter dated May 15, 1979)

Provide the flow rate (volume/time) for the ichthyoplankton sampling pump and the volume of water sampled during the 3-minute sampling periods. (P. 22, App. I)

RESPONSE:

The centrifugal pump according to the manufacturer's specification, discharges water at a rate of 385 gpm. Thus, approximately 4.37 m^3 of water were pumped and filtered for each qualitative sample.

313 305

NRC QUESTION 46 (NRC Letter dated May 15, 1979)

Were any ichthyoplankton pump samples taken at the depth and location of the proposed intakes? What are the results of that sampling. (P. 22, App. I)

RESPONSE:

Two circulating water intakes will be situated approximately 4,400 ft. offshore in about 28 ft. of water. In addition, service water intakes will be situated on the 24 and 32 ft. depth contours. Ichthyoplankton pump samples were collected only on the 20 ft. depth contour near the proposed service water intake on a monthly basis from April through September, 1974 during the baseline studies. In July, 51 alewife eggs and 2 slimy sculpin larvae were collected while in August, 44 alewife eggs and 10 slimy sculpin juveniles were collected.

A more intensive ichthyoplankton pump sampling program along both the 20 and 30 ft. depth contours was conducted during the 1977-78 interim program and is reported in Appendix K of the Environmental Report. However, only three alewife eggs were collected on the 20 ft. depth contour, while no eggs were found on the 30 ft. depth. No larvae were present in any of the ichthyoplankton pump samples collected on the intake transect at these two locations.

313 306

NRC QUESTION 47 (NRC Letter dated May 15, 1979)

Provide the rationale for using 1-1/2" mesh as the smallest mesh size for benthic gill net sampling rather than smaller sized mesh. (P. 20, App. I)

RESPONSE:

Three types of gear were used to collect adult and juvenile fish; namely, gillnets, trawl and seine. It was assumed that the gillnets would collect various sizes of most species of adult and juvenile fish inhabiting the area, while the seine would collect both juvenile and beach zone inhabitants (various cyprinids, etc.). The trawl was used to sample the pelagic fishes (alewife and smelt). With this assemblege of gear there was little need to add finer mesh netting to the gill nets.

313 307

NRC QUESTION 48 (NRC Letter dated May 15, 1979)

What was the catch efficiency of the midwater trawl?
(P. 20, App. I)

RESPONSE:

The efficiency of the midwater trawl utilized in the baseline study was not determined. However, it is known that trawls of similar construction used for the Point Beach Nuclear Plant studies often collected thousands of individuals. It should be noted that the studies conducted at Haven site were designed to yield both quantitative and qualitative estimates of species relative abundance. The seasonal patterns of species relative abundance at Haven site were similar to determinations made at several locations along the western shore of Lake Michigan.

313 308

NRC QUESTION 49 (NRC Letter dated May 15, 1979)

Provide drawings and specifications of proposed intake and discharge structures including locations, water depths, bottom type at location, and any impingement or entrainment mitigation devices.

RESPONSE:

Intake and discharge locations for closed-cycle cooling are provided on Figure 3.4-2 and described in Section 3.4 of the Environmental Report. The intake and discharge structures are shown on Figures 3.4-3 and 3.4-5, respectively.

Intake and discharge locations and structures for the proposed once-through cooling system, including the removable fixed-mesh screens used to minimize fish impingement, are described in Section 14 of the Environmental Report.

Lake bottom characteristics in the Haven site area are described in Appendix K of the Environmental Report.

313 309

NRC QUESTION 50 (NRC Letter dated May 15, 1979)

Provide a table or graph which documents fish species abundance and sizes, in the vicinity of the proposed intake and discharge structures through a 12-month period, including swimming performance at size.

RESPONSE:

Length frequency information for fish is provided in Appendix I of the Environmental Report and in Appendix B of the Applicants' 316(a) demonstration.

The topic of swimming performance for fish was addressed in the Response to Question 39.

313 310

NRC QUESTION 51 (NRC Letter dated May 15, 1979)

Provide a table listing important and dominant aquatic species of Lake Michigan in the Haven area and their preferred temperatures and temperature tolerances.

RESPONSE:

The preferred temperature range and temperature tolerance information for fish is provided in Sections 4.3, 4.4 and 4.5 of the Applicants' 316(a) demonstration.

313 311

NRC QUESTION 52 (NRC Letter dated May 15, 1979)

Provide a quantification or projection of impingement and entrainment. Using catch per unit effort with comparable gear at the Haven site and existing Lake Michigan power plants (e.g., Kewaunee and Point Beach) extrapolate from known impingement and entrainment to the Haven site.

RESPONSE:

Projected annual impingement and entrainment estimates for fish due to operation of Haven Nuclear Plant are provided in Section 5.1.3.4 of the Environmental Report.

313 312

NRC QUESTION 53 (NRC Letter dated May 15, 1979)

Will blasting be used for excavation of intake and discharge structures? If so, during what time of year will it occur, for what duration, and at what location.

RESPONSE:

It is anticipated that blasting will be utilized to excavate rock in the lake for the service water pipeline and the intake and discharge lines of the proposed once-through cooling system. Blasting will extend from the shoreline to a distance of approximately 1200 ft. offshore. Blasting in the lake should occur during one summer construction season for the service water pipeline and during another summer construction season for the once-through pipelines. Blasting will be limited to the months of June, July, August and September.

313 313

NRC QUESTION 54 (NRC Letter dated May 15, 1979)

Describe erosion prevention techniques which will be used on the shoreline and bluff.

RESPONSE:

Shoreline protection is described in Section 4.1 and shown on Figures 4.1-28 and 4.1-29 of the Environmental Report. Erosion control practices which will be used throughout the construction period in all areas of the site are also described in Section 4.1.

313 314

NRC QUESTION 55 (NRC Letter dated May 15, 1979)

Provide results of the lake trout potential spawning study.

RESPONSE:

The results of the ichthyoplankton study including the late autumn and winter pump sampling for lake trout eggs are summarized in Appendix K of the Environmental Report. No lake trout eggs or larvae were found near the proposed intake location nor in adjoining reference areas.

313 315

NRC QUESTION 56 (NRC Letter dated May 15, 1979)

In the ER, WE addressed the construction workforce as a total unit without developing a distribution of workers by skilled trade (i.e., number of boilermakers, carpenters, electricians, etc.). Also, not included in the ER was how and where these workers would be acquired. During the Haven site visit, these questions were addressed. WE's response suggested that the local union will be responsible for locating the workforce. To provide more specific data on the workforce, the chart below was developed. Its purpose is to show worker availability compared to skilled craft worker needs. Thus, by filling in the blanks, ANL may determine whether or not the local area (defined as a 50-mile radius) will be able to supply the construction workforce for the project.

Craft	Membership Strength[1] 12/78	Workers Needed[2]	Radius and/or Area Local Union Covers	How Many Workers Are Expected to be Employed From the Following Counties and Cities
Boiler makers				Sheboygan (county)
				Sheboygan (city)
Carpenters				Howards Grove
Electricians				Millersville (city)
Iron Workers				Kohler (city)
Operating Engineers				Sheboygan Falls (city)
				Manitowoc (county)
Fitters				Manitowoc (city)
Laborers				Cleveland All
Others				Ozaukee (county)
				Port Washington (city)
				Cedarburg (city)
				Mequon (city)
				Washington (county)
				West Bend (city)
				Germantown (village)
				Hartford (city)
				Fond du Lac (county)
				Fond du Lac (city)
				Winnebago (county)
				Oshkosh (city)
				Neenah (city)
				Brown (county)
				DePere (city)
				Allovez (city)
				Green Bay (city)
				Outagamie (county)
				Appleton (city)
				Waukesha (county)
				Menomonee Falls (village)

313 316

1 Refers to total number of members in union by skilled craft

2 Refers to workers needed by specific skilled craft for construction of plant.

RESPONSE

Specific estimates of the work force to be utilized during construction of the Haven Nuclear Project are provided in the attached table entitled "Work Force By Craft." Craft availability data are provided as of December 1977 when the survey was done for the Haven Nuclear Plant. Conclusions which can be drawn from the data are as follows:

1. Membership in the union locals having jurisdiction for the Haven Nuclear Plant is presently sufficient to meet the projected manpower requirement.

2. The majority of the trade union members reside in areas within reasonable commuting distances, which will significantly reduce the number of worker relocations to the plant site area.

313 317

WORK FORCE BY CRAFT
HAVEN NUCLEAR PLANT
WISCONSIN UTILITIES PROJECT

Craft	Approximate Membership Strength 12/77	Workers Needed[1] (Based on Peak Year for each Craft)	Area Local Union Covers	Area Where Craft Has a Majority of Membership
Boilermakers	250	90	State Wide	Eastern sector of state primarily Lake Michigan coastline
Carpenters[2]	2,000	287	Eastern portion of Wisconsin (except Waukesha county and city of Milwaukee)	Cities of: Fond du Lac Manitowoc, Appleton, Green Bay, Sheboygan
Electricians	3,400	247	Counties of: Milwaukee Washington Ozaukee Sheboygan Fond du Lac Waukesha	Counties of: Washington Ozaukee Waukesha
Operating Engineers	5,000	62	State Wide	Milwakee County and surrounding cities including Sheboygan
Pipe Fitters	365	270	Counties of: Sheboygan Fond du Lac Adams Dodge Winnebago Green Lake Waukesha	Cities of: Sheboygan Fond du Lac

313 318

Craft	Approximate Membership Strength 12/77	Workers Needed[1] (Based on Peak Year) for each Craft)	Area Local Union Covers	Area Where Craft Has a Majority of Membership
Laborers	1,000	236	Counties of: Fond du Lac Winnebago Manitowoc Sheboygan Calumet Marquette Dodge Green Lake Waukesha	Counties of: Fond du Lac Winnebago Manitowoc Sheboygan
All Others	Varies by Craft	370	Varies by Craft	Varies by Craft

313 319

[1] Peak for each craft will vary over the construction period, total does not correspond to peak year total for construction workforce.
[2] Carpenters Local No. 657 has recently been consolidated with the Fox River Carpenters District Council. This has resulted in the availability of a large source of carpenters, as shown.

NRC QUESTION 57 (NRC Letter dated May 15, 1979)

All baseline data provided by WE on the alternate sites was in the preliminary ER completed 1972-73. Since these data are approximately five years out of date, and changes are assumed to have taken place during this period of time (i.e., demograpny, and use, socioeconomics, etc.), request updated baseline data be provided on all alternative sites.

RESPONSE:

The response to this question was provided in Applicants' response to Question 1 of the March 14, 1979 NRC letter.

313 320

NRC QUESTION 58 (NRC Letter dated May 15, 1979)

Provide data, results and conclusions of the Wood site water quality study.

RESPONSE:

The response to this question was provided in Applicants' response to Question 2 of the March 14, 1979 NRC letter.

313 321

NRC QUESTION 59 (NRC Letter dated May 15, 1979)

Explain why additional units at existing power plants were not considered as an alternative to the proposed activity.

RESPONSE:

The response to this question was provided in Applicants' response to Question 3 of the March 14, 1979 NRC letter.

313 322

NRC QUESTION 60 (NRC Letter dated May 15, 1979)

Will the intake deicing system produce any change in water temperature near the intake? If yes, how much? (Section 3.4.3)

RESPONSE:

The electrical intake deicing system for the service water intake will not increase water temperatures in the vicinity of the intake. The intake deicing system for the proposed once-through cooling intakes is described in Section 14 of the Environmental Report and uses recirculated warm water for bar rack heating. This water is then discharged to the intake structure. Thus, no increase in water temperature in the vicinity of water intakes will occur.

313 323

NRC QUESTION 61 (NRC Letter dated May 15, 1979)

What will be the fate of any fish removed during screen cleaning? (Sec. 3.4.3)

RESPONSE:

All impinged fish and debris will be removed from the screen for disposal as waste.

313 324

NRC QUESTION 62 (NRC letter dated May 15, 1979

The concentrations of undisassociated amonia in the discharge is quite high (above the toxicity threshold for some fishes). What areas of the plume will contain such high concentrations? (Tables 3.6-5 and 5.4-2)

RESPONSE

The high concentrations of undisassociated ammonia in Tables 3.6-5 and 5.4-2 are attributable to typographical errors.

The combined waste average concentration of undisassociated ammonia in Table 3.6-5 should be "0.00052 milligrams per liter" rather than "0.52 milligrams per liter." The column heading "Stream Maximum" in Table 3.6-5 refers to the combined waste stream. Maximum concentrations of ammonia in Table 5.4-2 should be 2.6 milligrams per liter and 0.057 milligrams per liter, respectively, rather than 0.22 and 0.15 milligrams per liter. These tables will be revised accordingly.

The discharge containing undisassociated ammonia at the maximum concentration of 0.057 milligrams per liter would be diluted to the safe standard level (i.e., 0.02 milligrams per liter) at a distance no greater than 100 ft from the point of discharge, and included in the an area of approximately 0.05 acres.

313 325