J. McRill

final

NUREG-0191

environmental statement

related to operation of

LACROSSE BOILING WATER REACTOR

DAIRYLAND POWER COOPERATIVE

APRIL 1980

Docket No. 50-409

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U. S. Nuclear Regulatory Commission • Office of Nuclear Reactor Regulation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

June 11, 1980

Docket No. 50-409

Mr. Frank Linder
General Manager
Dairyland Power Cooperative
2615 East Avenue South
La Crosse, Wisconsin 54601

Dear Mr. Linder:

Enclosed are revised pages 5-11, 5-12, 5-17 and 5-31 to the Final Environmental Statement (NUREG-0191) related to the operation of the La Crosse Boiling Water Reactor. These pages include corrections related to occupational radiation exposure. Please replace the existing pages with the enclosed corrected pages.

Sincerely,

Dennis M. Crutchfield

Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
Division of Licensing

Enclosures:
As stated

cc w/enclosure:
See next page

Copies: SRC
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(2) Radiation Dose Commitments to Populations

The estimated annual radiation dose commitments to the population within 80 km of the La Crosse nuclear plant from gaseous and particulate releases are shown in Table 5.5-4. Beyond 80 km, the doses were evaluated using average population densities and food production values discussed in Appendix E. Estimated dose commitments to the U.S. population are shown in Table 5.5-5. Background radiation doses are provided for comparison. The dose commitments from atmospheric releases from the La Crosse facility during normal operation represent a small increase in the normal population dose due to background radiation sources.

Dose Commitments from Radioactive Liquid Releases to the Hydrosphere

Radioactive effluents released to the hydrosphere from the La Crosse facility during normal operation will result in small radiation doses to individuals and populations. NRC staff estimates of the expected liquid releases listed in Table 3.6-2 and the site hydrological considerations discussed in Section 2.5 of this statement and summarized in Table 5.5-6 were used to estimate radiation dose commitments to individuals and populations. The results of the calculations are discussed below.

(1) Radiation Dose Commitments to Individuals

The estimated dose commitments to the maximum individual from liquid releases at selected off-site locations are listed in Tables 5.5-3 and 5.5-4. The maximum individual is assumed to consume well above average quantities of the foods considered and spend more time at the shoreline than the average person (see Table E-5 in Regulatory Guide 1.109).

(2) Radiation Dose Commitments to Populations

The estimated annual radiation dose commitments to the population within 80 km of the La Crosse nuclear plant from liquid releases, based on the use of water and biota from the Mississippi River, are shown in Table 5.5-4. Dose commitments beyond 80 km were based on the assumptions discussed in Appendix E. Estimated dose commitments to the U.S. population are shown in Table 5.5-5. Background radiation doses are provided for comparison. The dose commitments from liquid releases from the La Crosse facility during normal operation represent a small increase in the normal population dose due to background radiation sources.

Direct Radiation

(1) Radiation from the Facility

Radiation fields are produced in nuclear plant environs as a result of radioactivity contained within the reactor and its associated components. Although these components are shielded, dose rates around the plants have been observed to vary from undetectable levels to values of the order of 1 rem/year.

Doses from sources within the plant are primarily due to nitrogen 16, a radionuclide produced in the reactor core. For boiling water reactors, nitrogen-16 is transported with the primary coolant to the turbine building. The orientation of piping and turbine components in the turbine building determines, in part, the exposure rates outside the plant. Because of variations in equipment lay-out, exposure rates are strongly dependent upon overall plant design.

Based on the radiation surveys which have been performed around several operating BWRs, it appears to be very difficult to develop a reasonable model to predict direct shine doses. Thus, older plants should have actual measurements performed if information regarding direct radiation and sky-shine rates is needed.

Low level radioactivity storage containers outside the plant are estimated to contribute less than 0.01 mrem/year at the site boundary.

(2) Occupational Radiation Exposure

For the purpose of projecting the radiological impact of plant operation on all on-site personnel, it is possible to estimate an average annual man-rem occupational radiation dose. For a 1000 MWe plant designed and operated in a manner consistent with 10 CFR Part 20, there will be many variables which influence exposure and make it impossible to determine in advance a specific quantitative total occupational radiation dose for a particular plant. Therefore, past exposure experience from operating nuclear power stations has been used as the basis for an estimate to be used for 1000 MWe plants. This experience indicates a projected average annual value of 600 man-rems per reactor unit, with individual plant annual occupational doses from approximately 50 to 5000 man-rems depending on specific plant operations.

However, in the case of LACBWR, operating data are available on actual occupational doses incurred during the life of the plant. Annual average worker doses at LACBWR reported from 1972-1978 varied from a high of 1.59 rem per worker to a low of 0.72 rem per worker with the average being 1.17 rem per worker. The average dose per year reported for LACBWR for the period 1970-1978 is 170 man-rems. Reported average worker doses and annual average man-rem values for similar operating periods for other small plants are 0.78 rem/worker and 223 man-rem/yr (Big Rock Point-64 MWe); 1.5 rem/worker and 476 man-rem/yr (Humboldt Bay-63 MWe); and 0.67 rem/worker and 193 man-rem/yr (Yankee Rowe-175 MWe).*

On the basis of this operating experience at LACBWR and at other plants of comparable size, we would not expect occupational radiation doses to be as large as the 600 man-rems per year per reactor unit experienced at larger plants. For purposes of estimating the environmental impact of occupational radiation doses at LACBWR, we have projected an average annual value of 200 man-rems.

(3) Transportation of Radioactive Material

The transportation of cold fuel to a reactor, of irradiated fuel from the reactor to a fuel reprocessing plant, and of solid radioactive waste from the reactor to burial grounds is within the scope of the NRC report entitled, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants." The estimated population dose commitments associated with transportation of fuels and wastes are listed in Tables 5.5-5 and 5.5-7.

5.5.3 Radiological Impact on Man

The actual radiological impact associated with the operation of the proposed La Crosse nuclear power station will depend, in part, on the manner in which the radioactive waste treatment system is operated. Based on the NRC staff's evaluation of the potential performance of the radwaste system, it is concluded that the system as proposed is capable of meeting the dose design objectives of 10 CFR Part 50, Appendix I. Table 5.5-4 compares the calculated maximum individual doses to the dose design objectives. However, since the facility's operation will be governed by operating license technical specifications and since the technical specifications will be based on the dose design objectives of 10 CFR Part 50, Appendix I, as shown in the first column of Table 5.5-4, the actual radiological impact of plant operation may result in doses close to the dose design objectives. Even if this situation exists, the individual doses will still be very small when compared to natural background doses (~ 100 mrem/yr) or of the dose limits specified in 10 CFR Part 20. As a result, the staff concluded that there will be no measurable radiological impact on man from routine operation of the plant.

*NUREG-0594, Occupational Radiation Exposure at Commercial Nuclear Power Reactors 1978, published November 1979.

Correction: June 1980

Table 5.5-5

ANNUAL TOTAL BODY POPULATION DOSE COMMITMENTS IN THE YEAR 1970

CATEGORY	U.S. POPULATION DOSE COMMITMENT
Natural Background Radiation[a] (man-rem/yr)	21,000,000
La Crosse Nuclear Plant Operation (man-rem/yr/site)	
Plant Workers	200
General Public:	
Radioiodine and Particulates	27
Liquid Effluents	7
Noble Gas Effluents	1.6
Transportation of Fuel and Waste	7

[a]Using the average U.S. background dose (100 mrem/yr) in (a), and year 1970 U.S. population from "Population Estimates and Projections," Series II, U.S. Department of Commerce, Bureau of the Census, Series P-25, No. 541 (Feb. 1975).

Table 5.5-6

SUMMARY OF HYDROLOGIC TRANSPORT AND DISPERSION FOR LIQUID RELEASES FROM THE LA CROSSE NUCLEAR POWER STATION[a]

LOCATION	TRANSIT TIME (Hours)	DILUTION FACTOR
Nearest Drinking Water Intake (Pool No. 9)	22	356
Nearest Sport Fishing Location (South end of Thief Slough)	1.1	107

[a]See Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Table 5.5-7

ENVIRONMENTAL IMPACT OF TRANSPORTATION OF FUEL AND WASTE TO AND FROM ONE LIGHT-WATER-COOLED NUCLEAR POWER REACTOR

Normal Conditions of Transport

Heat (per irradiated fuel cask in transit)	260 MJ/hr
Weight (governed by Federal or State restrictions)	33,000 kg. per truck; 90 tonnes per cask per rail car
Traffic density:	
Truck	< 1 per day
Rail	< 3 per month

Exposed population	Estimated number of persons exposed	Range of doses to exposed individuals[a] (millirems per reactor year)	Cumulative dose to exposed population (man-rems per reactor) year)[b]
Transportation Worker	200	0.01 to 300	4
General Public:			
Onlookers	1,100	0.003 to 1.3	
Along Route	600,000	0.0001 to 0.06	3

Accidents in Transport

Radiological Effects	Small[c]
Common (nonradiological) causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year

[a]The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5,000 millirems/year for individuals as a result of occupational exposure and should be limited to 500 millirems/year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 millirems/year.

[b]Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1,000 people were to receive a dose of 0.001 rem (1 millirem), or if 2 people were to receive a dose of 0.5 rem (500 millirems) each, the total cumulative dose in each case would be 1 man-rem.

[c]Although the environmental risk of radiological effects stemming from transportation accidents cannot currently be numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multi-reactor site.

Source: Data supporing this table are given in the Commission's Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238, December 1972, and Supplement I, NUREG-75/038, April 1975. The number "130 millirem in note "a" to this table is not in current use. About 100 millirem/yr is currently used for average background radiation in the U.S.

5.8.6 Radioactive Wastes

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) are specified in Table S-3. For low-level waste disposal at land burial facilities, the Commission notes in Table S-3 that there will be no significant radioactive releases to the environment. For high-level and transuranic wastes, the Commission notes that these are to be buried at a Federal repository, and that no release to the environment is associated with such disposal. It is indicated in NUREG-0116,[18] which provides background and context for the high-level and transuranic Table S-3 values established by the Commission, that these high-level and transuranic wastes will be buried and will not be released to the biosphere. No radiological environmental impact is anticipated from such disposal.

5.8.7 Occupational Dose

The average annual occupational radiation dose to workers at LACBWR has been less than 200 man-rems. The annual occupational dose attributable to the rest of the fuel cycle for the model 1000 MWe LWR is about 200 man-rems. The comparable value for LACBWR is unlikely to exceed 200 man-rems. The staff concludes that this occupational dose will not have a significant environmental impact.

5.8.8 Transportation

The transportation dose to workers and the public is specified in Table S-3. This dose is small and is not considered significant in comparison to the natural background dose.

5.8.9 Fuel Cycle

The staff's analysis of the uranium fuel cycle did not depend on the selected fuel cycle (no recycle or uranium-only recycle), since the data provided in Table S-3 include maximum recycle option impact for each element of the fuel cycle. Thus, the staff's conclusions as to acceptability of the environmental impacts of the fuel cycle are not affected by the specific fuel cycle selected.

NUREG-0191
APRIL 1980

FINAL ENVIRONMENTAL STATEMENT

BY THE

U. S. NUCLEAR REGULATORY COMMISSION

FOR

LACROSSE BOILING WATER REACTOR

proposed by

DAIRYLAND POWER COOPERATIVE

Docket No. 50-409

SUMMARY AND CONCLUSIONS

This Environmental Statement was prepared by the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation.

1. This action is administrative.

2. The proposed action is the conversion of Provisional Operating License No. 45 to a full-term operating license for the La Crosse Boiling Water Reactor (Docket No. 50-409) (also known as Genoa 2), operated by the Dairyland Power Cooperative and located on the Mississippi River in Vernon County, Wisconsin.

The La Crosse Boiling Water Reactor (LACBWR) was completed in 1967 and has been in operation since 1969. The plant employs one boiling water reactor to produce up to 165 megawatts thermal (MWt). A steam turbine-generator uses this heat to provide a nominal 50 Mw (net) of electrical power capacity. The exhaust steam is cooled by a once-through flow of water obtained from the Mississippi River and discharged to it.

3. Summary of past and present environmental impacts and adverse effects.

(a) Approximately 27 acres of river edge and forested lowland were filled with material dredged from the Mississippi River. Total land committed to the three plant site is 163.5 acres. LACBWR occupies about one third of the area. (Sec. 2.1 and 4.1)

(b) Partial removal of a small rock-fill dam from the slough or channel of the river into which LACBWR discharges probably helped to restore stream behavior to a condition more nearly approximating its original state. (Sec 4.2)

(c) Minor and temporary impacts to the biota of the station area probably occurred during construction; however, no permanent impacts have been identified. (Sec 4.3.2)

(d) At 80% capacity factor, about 2.0×10^{10} gallons per year of water are used for condenser cooling. Approximately 1.1×10^{9} gallons per year of river water are used in the plant low-pressure system, and about 6×10^{7} gallons per year of groundwater are used. Evaporative loss from the discharge is insignificant relative to the river flow. (Sec 5.2)

(e) No adverse thermal effect on the aquatic biota has been noted to date. (Sec 5.3.2 and 5.6.2)

(f) Entrainment mortality should lie between 0.1% and 2.5% of the river's total entrainable biota under 7-day 10-year low flow conditions. No widespread or long-term impact is expected. (Sec 5.6.2)

(g) The risk associated with accidental radiation exposure is very low. (Sec 7.1)

(h) No significant environmental impacts are anticipated from normal operational releases of radioactive material. The estimated dose to the offsite population within 50 miles from operation of the plant is calculated to be no greater than 3 man-rem/yr. This is a small fraction of the 29,000 man-rem/yr natural environmental radiation dose this population would receive. (Table 5.5-4)

4. Principal alternatives considered:

Replacement of capacity by purchased power, construction of new capacity
Alternative cooling methodology
Alternative waste treatment systems

5. The following Federal, State, and local agencies were asked to comment on the Draft Environmental Statement:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers

Department of Commerce
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Federal Energy Administration
Federal Power Commission
Wisconsin Department of Natural Resources
Wisconsin Public Service Commission
Wisconsin Department of Administration
Iowa Office for Planning and Programming
Minnesota State Department of Health

Comments on the Draft Environmental Statement were received from the following:

Advisory Council on Historic Preservation
Department of Agriculture
Department of Commerce
Department of Health, Education, and Welfare
Department of the Interior
Environmental Protection Agency
Energy Research and Development Administration
Mississippi River Regional Planning Commission
Wisconsin Department of Natural Resources
Wisconsin Department of Administration
Wisconsin State Historical Society
Iowa Office for Planning and Programming
The Kickapoo Scout
Dairyland Power Cooperative

Copies of these comments are appended to this Final Environmental Statement as Appendix A. The staff has considered these comments, and the responses are located in Sec. 11.

6. The Draft Environmental Statement was made available to the public, to the Council on Environmental Quality, and to other specified agencies in June 1976.

7. On the basis of the analysis and evaluation set forth in the statement; after weighing the environmental, economic, technical, and other benefits of the La Crosse Boiling Water Reactor against environmental and other costs; and considering available alternatives; it is concluded that the action called for under the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51 is the conversion from a provisional operating license to a full-term operating license subject to the following conditions for the protection of the environment:

(a) License Conditions

Before engaging in additional construction or operational activities which may result in a significant adverse environmental impact that was not evaluated or that is significantly greater than that evaluated in this Environmental Statement, the applicant shall provide written notification to and obtain prior approval from the Director, Office of Nuclear Reactor Regulation.

If unexpected harmful effects or evidence of irreversible damage are detected during the operation of the plant, whether by a monitoring program or by other means, the applicant shall provide the staff an acceptable analysis of the problem and an acceptable plan of action to eliminate or significantly reduce the harmful effects of damage.

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FOREWORD

This environmental statement was prepared by the U. S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation (staff) in accordance with the Commission's regulation, 10 CFR Part 51, which implements the requirements of the National Environmental Policy Act of 1969 (NEPA).

The NEPA states, among other things, that it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice.
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Further, with respect to major Federal actions significantly affecting the quality of the human environment, Section 102(2)(C) of the NEPA calls for preparation of a detailed statement on:

(i) the environmental impact of the proposed action,

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) alternatives to the proposed action,

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

An environmental report accompanies each application for a construction permit or a full-power operating license. A public announcement of the availability of the report is made. Any comments by interested persons on the report are considered by the staff. In conducting the required NEPA review, the staff meets with the applicant to discuss items of information in the environmental report, to seek new information from the applicant that might be needed for an adequate assessment, and generally to ensure that the staff has a thorough understanding of the proposed project. In addition, the staff seeks information from other sources that will assist in the evaluation, and visits and inspects the project site and surrounding vicinity. Members of the staff may meet with State and local officials who are charged with protecting State and local interests. On the basis of all the foregoing and other such activities or inquiries as are deemed useful and appropriate, the staff makes an independent assessment of the considerations specified in Section 102(2)(C) of the NEPA and 10 CFR 51.

This evaluation leads to the publication of a draft environmental statement, prepared by the Office of Nuclear Reactor Regulation, which is then circulated to Federal, State, and local governmental agencies for comment. A summary notice is published in the Federal Register of

the availability of the applicant's environmental report and the draft environmental statement. Interested persons are requested to comment on the proposed action and the draft statement.

After receipt and consideration of comments on the draft statement, the staff prepares a final environmental statement, which includes a discussion of questions and objections raised by the comments and the disposition thereof; a final benefit-cost analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects with the environmental, economic, technical, and other benefits of the facility; and a conclusion as to whether--after the environmental, economic, technical, and other benefits are weighed against environmental costs and after available alternatives have been considered--the action called for, with respect to environmental issues, is the issuance or denial of the proposed permit or license, or its appropriate conditioning to protect environmental values.

Single copies of this statement may be obtained as indicated on the inside front cover.

Dr. Robert Geckler is the NRC Environmental Project Manager for this plant. Should there be questions regarding the content of this statement, Dr. Geckler may be contacted at the following address or by calling (301) 492-8429.

Division of Site Safety and Environmental Analysis
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

1. INTRODUCTION

1.1 THE PROJECT

The La Crosse Boiling Water Reactor (LACBWR) is a nuclear electric power station operated by the Dairyland Power Cooperative (DPC). It was built as part of the Atomic Energy Commission's second-round power reactor demonstration program by Allis-Chalmers Manufacturing Company under a contract with the Commission signed in June 1962. The site for the reactor was provided by DPC. The construction permit was issued in November 1962. The plant was completed in 1967 and has a capacity of 50 MWe. The reactor was operated initially by Allis-Chalmers for the Commission under Provisional Operating Authorization No. DPRA-5. In August 1973, arrangements for purchase from the AEC were completed and DPC assumed ownership of the facility, receiving a Provisional Operating License (No. DPR 45) on August 28, 1973.

As required by (now) 10 CFR 51.21, DPC submitted an Environmental Report to the Director of Regulation in anticipation of filing a complete application for a full-term operating license (Docket No. 50-409). The Director of Regulation, or his designee, is required by the same regulation to analyze the environmental report and prepare a detailed statement of environmental considerations. It is with this framework that this Environmental Statement has been prepared by the NRC staff. The proposed action is the conversion of Provisional Operating License No. 45 to a full-term operating license of 20 years duration. Copies of the Environmental Report and this Environmental Statement are available for public inspection at the NRC Public Document Room, 1717 H Street NW, Washington, DC, and at the Public Library in La Crosse, Wisconsin.

1.2 STATUS OF REVIEWS AND APPROVALS

Although a number of approvals and certifications from various State and Federal agencies were required for construction and operation of LACBWR during the past decade (see the detailed listing in the Environmental Report,* Section 12, for those permits and approvals applicable during this period) only two appear pertinent to the proposed action. The first, the Provisional Operating License (No. DPR 45), was issued by the AEC on August 28, 1973. A Wisconsin Pollutant Discharge Elimination Permit (WPDEP) was issued under Section 402 of the Federal Water Pollution Control Act on December 31, 1974, and was last renewed on September 28, 1979.

*Dairyland Power Cooperative, Environmental Report and Supplemental Information (Docket No. 50-409). Hereinafter in this Environmental Statement, the applicant's Environmental Report, dated December 1972, and Supplementary Information, dated variously, will be referred to as the ER. Citations will appear in the body of the text and will be enclosed in parentheses. The ER citation will be followed by a specific section, page, figure, table, appendix, or supplement identification.

2. THE SITE

2.1 SITE DESCRIPTION

The second unit of Dairyland Power Cooperative (DPC) located at the Genoa site is commonly referred to as the La Crosse Boiling Water Reactor (LACBWR). This unit, also known as Genoa 2, is on the east shore of the Mississippi River in the Village of Genoa, Vernon County, Wisconsin. The location coordinates are latitude 43° 33' 53" North, longitude 91° 13' 53" West. The site is at mile 678.6 above the mouth of the Ohio River. U.S. Lock and Dam No. 8 is about 3300 feet upstream from the site.

The LACBWR and two fossil-fueled steam plants are located on 163.5 acres in Section 32, Town 13 No., Range 7W, which is owned in fee by DPC (Fig. 2.1-1). About 27 acres of the land were formed by filling river edge and low forest with material dredged from the Mississippi River. The reactor stands on filled land at an elevation of 639 feet MSL, or 19 feet above the normal elevation of the river. The reactor is 300 feet from the river bank and 475 feet west of the railroad.

The facility is 17 miles south of the City of La Crosse and a mile south of the Village of Genoa. The nearest community (three miles to the northwest) on the west shore is Reno, Minnesota, an unincorporated hamlet of about 60 people. The nearest community in Iowa is New Albin (pop. 664), five miles south of the plant. Victory, Wisconsin, five miles south of the plant on the east shore, is an unincorporated hamlet of about 80 people.

The nearest river crossing is 14 miles downstream from the reactor at Lansing, Iowa (pop. 1218).

The nearest commercial airport with scheduled passenger service is at La Crosse, approximately 19 miles north of the site. Two unimproved airports are within a 25-mile radius of LACBWR. These are the Houston County (Minnesota) airport, about 13 miles to the west of the plant, and the Viroqua airport, 17 miles to the east.

Approximately 950 feet north of the LACBWR is Genoa 1, a 13-MWe oil-fired generating plant with a 72-foot stack. Genoa 3, a 350-MWe coal-fired generating facility, is approximately 175 feet south of the LACBWR. The main building is 232 feet long, and the adjacent service building is 160 feet long. The Genoa 3 stack rises 500 feet above grade elevation.

The exclusion area is also shown in Fig. 2.1-1. The minimum radius of the exclusion area is 1109 feet (0.21 mile) which is the area of access controlled by DPC.

Approximately 3000 feet south of the LACBWR, on DPC property but outside the exclusion area, is a public boat launching ramp with a parking lot that can accommodate over 100 cars with boat trailers. An estimated 30 cars normally use the lot, although it is sometimes full during peak holiday or weekend periods. The lot is entered by the river access road, which runs parallel to and just west of the railroad tracks. The road runs south from the site entrance for approximately 1500 feet, then southwesterly to the parking lot (Fig. 2.1-1).

2.2 REGIONAL DEMOGRAPHY, LAND AND WATER USE

2.2.1 Population

In this section, population data are presented in terms of distance and direction from the LACBWR site. The area within a 50-mile radius of the site has been divided concentrically into rings and, by compass direction, into 16 sectors of 22° 30' each. The sectors are centered on the compass points indicated. Within each sector, population is given by one-mile increments for the first five miles, by the five-mile increment to 10 miles, and by 10-mile increments to 50 miles (Table 2.2-1). Table 2.2-2 lists the data in cumulative form.

Based on 1970 census data, approximately 320,000 people live within a 50-mile radius of the LACBWR. Of this population, about a quarter is accounted for by the City of La Crosse and the neighboring communities of Onalaska, Wisconsin, and La Crescent, Minnesota, which comprise an

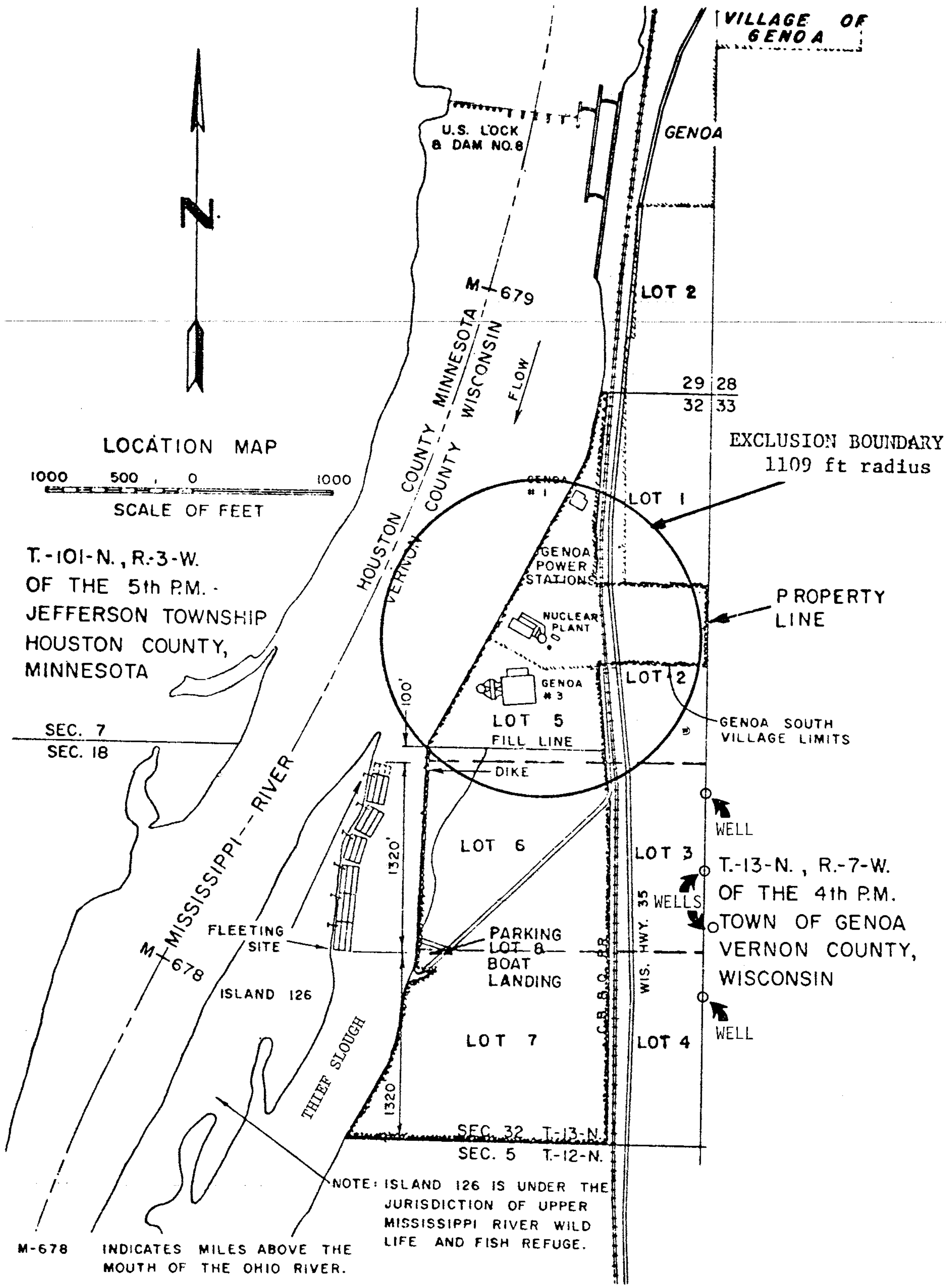

Fig. 2.1-1. LACBWR Site Map. (Modified from the ER.)

Table 2.2-1. Incremental Population Out to 50 Miles from the LACBWR Site

Direction	Distance (mi)									
	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	4	12	24	12	32	750	51,506	16,850	3,392	3,113
NNE	50	270	20	28	24	1,002	3,034	5,751	2,639	2,114
NE	0	12	12	8	44	224	2,020	1,452	9,884	8,212
ENE	4	8	4	32	32	712	1,554	3,927	4,164	3,791
E	0	8	12	12	72	0	6,232	2,158	1,756	3,859
ESE	12	16	16	12	24	0	1,590	2,280	1,651	9,970
SE	16	16	12	20	16	0	0	2,144	4,871	3,748
SSE	58	8	36	40	24	472	860	2,107	2,106	3,367
S	0	8	12	0	20	216	2,061	1,497	8,071	4,969
SSW	0	0	0	0	215	229	383	4,198	5,358	3,457
SW	0	0	0	8	20	664	212	2,916	2,790	6,216
WSW	0	0	12	12	12	206	955	1,446	10,201	7,605
W	0	0	8	12	16	0	951	3,597	3,821	2,938
WNW	0	0	4	24	12	304	4,100	691	4,283	2,428
NW	0	0	0	60	24	0	403	1,976	2,298	8,910
NNW	0	0	0	0	12	417	5,868	2,393	17,948	14,959
Total	144	358	172	280	599	5,176	81,729	55,383	85,233	89,656

Source: ER and 1970 census of population.

Table 2.2-2. Cumulative Population Out to 50 Miles from the LACBWR Site

Direction	Distance from Site (mi)									
	1	2	3	4	5	10	20	30	40	50
N	4	16	40	52	84	782	52,288	69,138	72,530	75,643
NNE	50	320	340	368	392	1,394	5,430	11,181	13,820	15,934
NE	0	12	24	32	76	300	2,320	3,442	13,656	21,868
ENE	4	12	16	48	80	792	2,346	6,273	10,437	14,228
E	0	8	20	32	104	104	6,336	8,494	10,250	14,109
ESE	12	28	44	56	80	80	1,670	3,950	5,601	15,571
SE	16	32	44	64	80	80	80	2,224	7,095	10,843
SSE	58	66	102	142	166	638	1,498	3,605	5,711	9,078
S	0	8	20	20	40	256	2,317	3,814	11,885	16,854
SSW	0	0	0	0	215	444	827	5,025	10,383	13,840
SW	0	0	0	8	28	672	884	3,800	6,590	12,806
WSW	0	0	12	24	36	242	1,197	2,643	12,844	20,449
W	0	0	8	20	36	36	987	4,584	8,405	11,343
WNW	0	0	4	28	40	344	4,440	5,135	9,418	11,846
NW	0	0	0	60	84	84	487	2,463	4,761	13,671
NNW	0	0	0	0	12	429	6,297	8,690	26,638	41,597
Total	144	502	674	954	1,553	6,729	88,458	143,841	229,074	318,730

Source: ER and 1970 census of population.

urbanized area centered approximately 17 miles north of the reactor site and by Winona, Minnesota, about 45 miles away.

The immediate vicinity of the LACBWR site is sparsely populated. Only 6729 people live within a ten-mile radius, and 1553 within a five-mile radius. The largest community within the five-mile radius is the Village of Genoa which had a 1970 population of 305. The bulk of its population, 270 persons, is located NNE of the site beyond the one-mile radius. In Table 2.2-3 are listed the incorporated communities within 25 miles of the site.

For the purpose of estimating ~~1970 population, the~~ zones were divided into two categories. The first category consists of the 80 zones within the initial five-mile radius. The second consists of the remaining zones between the five-mile and 50-mile radii.

The zones in the first category are relatively small. Those within a one-mile radius of the plant have an area of approximately 125.6 acres. Those between the four-mile and five-mile radii are approximately 1130 acres or 1.8 square miles. Since census data on such a fine scale are not available, DPC used United States Geological Survey maps and counted the number of homes in each zone, multiplying by an occupancy factor of four to determine the approximate population within a five-mile radius of the site.

Population projections for the year 2010 have been calculated ~~(using accepted methodology) by~~ the applicant. Most of the population growth is expected to occur in and around the City of La Crosse. Overall, the total projected population growth for the area in the year 2010 is expected to be less than 5%.

Table 2.2-3. Cities, Towns, and Villages Within 25 Miles of LACBWR

Community	Distance from Site (mi)	Direction From Site	Population
Genoa Village	1	N	305
Reno (uninc.)	3	NW	60
New Albin Town	5	S	644
Victory (uninc.)	5	S	80
Stoddard Village	6.5	N	750
Chaseburg Village	9	NE	224
Brownsville Village	9	NNW	417
De Soto Village	10	S	295
Eitzen Village	12.5	WSW	208
Caledonia Village	14	WNW	2,619
Lansing Town	14.5	S	1,218
Hokan Village	15	NNW	697
Coon Valley Village	16	NE	596
Ferryville Village	17	SSE	183
La Crosse City	17	N	51,153
La Crescent Village	18	NNW	3,142
Viroqua	18	E	3,739
Gays Mills Village	20	SE	623
Westby City	20	ENE	1,568
Spring Grove Village	21	W	1,290
Houston Village	22	NW	1,090
Onalaska City	22	N	4,090
Mount Sterling Village	22	SE	181
Lynxville Village	23	SSE	149
Waukon City	24	SW	3,883
Waterville Town	24	S	158
Readstown Village	24	ESE	395
Soldiers Grove Village	25	ESE	514
West Salem Village	25	NNE	2,180
Dakota Village	25	NNW	369

Source: 1970 Census of Population.

From the ER.

The applicant assumed that zone populations will change at the same rate as those of the counties in which the zones are located. Using the 1990 population projections for each zone, the population for 1980 was interpolated, and populations for the years 2000 and 2010 were extrapolated assuming a linear rate of growth or decline between 1970 and 2010. Because of the small expected changes, these data are not included here.

2.2.2 Land Use

The area within a 50-mile radius of the LACBWR site includes portions of three States and all or part of 21 counties. The area within a five-mile radius is predominantly in Vernon County, Wisconsin, and Houston County, Minnesota, but also includes a small portion of Allamakee County, Iowa.

Agriculture and forestry are the predominant land uses in Vernon County as well as in the neighboring counties on the west side of the Mississippi River. Nearly 94% of the county's gross area is in agriculture and woodlands. About 3.4%, consisting mainly of water area and marshlands, is classified as undeveloped. Total developed land accounts for less than 2.8% of the county's gross area.

The primary agricultural activity is dairy farming. The major cash crop is tobacco, Vernon County producing more of this crop than any other county in Wisconsin. In recent years, there has been a marked trend toward the conversion of Vernon County's marginal agricultural land to woodland. About two-fifths of the total land in farms is now devoted to woodland.

The forests yield substantial amounts of oak and lesser quantities of maple and other hardwoods. A modest amount of sandstone and limestone quarrying also takes place at a number of sites throughout the county. Further, 85% of the developed land is in the low-intensity-use categories of residential and park land. The more intensive land uses (industry, commerce, public, transportation, and utilities) account for less than 15% of total developed land and less than 0.3% of gross area. Local industry consists almost exclusively of operations related to the processing of agricultural and forest products. One notable exception is the recent growth of nonagricultural industries of the industrial park in Viroqua.

Land in the vicinity of the LACBWR site is overwhelmingly rural and undeveloped. Of the area within a five-mile radius, approximately one third is accounted for by water area and bottomlands included in the Upper Mississippi River Wildlife and Fish Refuge. The developed portion of the Village of Genoa, the only substantial community in the immediate vicinity of the site, occupies less than 100 acres.

Refuge bottomland and water surface, lying mainly in Minnesota, extend west of the reactor site for 2.5 miles. Roughly a third of the area remains under cultivation. A few dozen residences, including many vacation homes and boathouses, are scattered along the shoreline near State Highway 26, and houseboats are moored at several points.

Approximately 3.5 square miles of Iowa are within the LACBWR five-mile radius. Most of it is water area and refuge bottomland, although there is some agricultural use on the inshore bottomland. The five-mile radius includes a portion of the incorporated town of New Albin, whose total population is 644.

The Mississippi River Regional Planning Commission (MRRPC) has provided assistance to Vernon County in developing a comprehensive zoning ordinance. The County has now adopted this ordinance; however, as per Wisconsin Statutes, it is not effective in any Town until it is ratified by the Town Board. The Genoa Town Board has not yet ratified this ordinance. The county-wide flood plain zoning ordinance is in effect. The rural Town and the Village of Genoa have a flood plain ordinance within the Village limits. There is no general zoning ordinance in the Village.

There are no institutions other than day schools within ten miles of the LACBWR. (The term "institution," as used here, includes schools, hospitals, prisons, asylums, and other uses that entail the presence of groups of students, patients, inmates, or other persons under supervision.)

The only school within five miles of the LACBWR site is the St. Charles Elementary School, a Roman Catholic parochial school in the Village of Genoa approximately one mile north of the LACBWR. Seven other schools are located at varying distances from the site up to ten miles.

Traffic counts for the portion of Highway 35 east of the reactor site indicate an average volume of 2450 vehicles per day (1971).

The Burlington Northern Railroad tracks east of the LACBWR site are used by an average of 24 trains per day, having an average length of 90 cars per train. The tracks are no longer used by passenger trains.

2.2.3 Water Use

Virtually all municipal water supplies for cities and towns along the river downstream from the site for a distance of at least 40 miles are obtained from groundwater. The nearest major city using the Mississippi as a source of water for municipal supply is Davenport, Iowa, about 195 miles downstream from the reactor site. According to a canvass made in June 1962 by DPC, the only industrial use made of river water between the reactor site and Prairie du Chien, 40 miles downstream, is at the power plant below Lansing, Iowa. Shallow, low yield, domestic wells are also in use throughout the area.

The Upper Mississippi River is a major waterway for commercial barge traffic as well. The river is regulated for navigational purposes by a series of 28 locks and dams. These assure a minimum channel depth of nine feet from Alton, Illinois, to Minneapolis. The locks and dams are numbered from north to south. Lock and Dam No. 8 is at Genoa (mile 679.2), about 3300 feet upstream from the LACBWR. Pool No. 8, which is the portion of the river upstream of Dam No. 8, extends 23.3 miles to the next dam upstream, No. 7, which is at Dresbach, Minnesota. Lock and Dam No. 9 is 31.3 miles below Genoa, at Lynxville, Wisconsin.

The average navigation season for the Upper Mississippi from Rock Island to Minneapolis runs from April 10 to December 1. However, lockages at Lock No. 8 generally commence in early March and extend to about December 10. The 1971 season at Lock No. 8 was March 4 to December 15, a total of 287 days.

The main commodities barged are outbound grain and inbound coal and petroleum products. The LACBWR's sister station, Genoa 3, is a major destination for coal-barge traffic. The nearest port facilities for barges are at La Crosse.

2.2.4 Recreation

The Upper Mississippi Wildlife and Fish Refuge, which includes the bulk of the river surface and bottomlands, is the focus of recreational activity in the region. Numerous public and private launching ramps provide boating access to the refuge area. Fishing and hunting are permitted, except in designated closed areas. There are no specific camping areas, but camping is permitted on the refuge's many islands and sandbars. Since access is only by boat, all camping is of a primitive nature.

Camping, hunting, hiking, and stream fishing are available in the Minnesota Memorial Hardwood State Forest, which includes about 4000 acres of upland in the riparian townships of Jefferson and Crooked Creek, immediately opposite the LACBWR site.

Within five miles of the LACBWR, there are eight launching ramps that provide entry to the Mississippi for small craft. One of these is the boat access on the DPC property which is maintained by Vernon County.

Blackhawk Memorial Park, seven miles south, is on 337 acres of Federal land and is operated by Vernon County under license from the Corps of Engineers. Activities include camping, fishing, boating, and picnicking. Total annual attendance was estimated in 1968 at 25,000-30,000. An estimated 3000 campers used the park in 1971.

Another county park, also on Federal land, is 26-acre Stoddard Landing, seven miles north of the reactor. The only State park in Vernon County is Wildcat Mountain, approximately 35 miles northeast of the LACBWR. There are two State-maintained waysides off State Highway 35, one just south of Stoddard and the other about a half-mile north of the LACBWR opposite Lock No. 8. The State Department of Transportation, Division of Highways, maintains a scenic overlook approximately three miles north of LACBWR on Highway 35.

The MRRPC and Vernon County Outdoor Recreation Plan identify several potential recreational areas. The Bad Axe River mouth site is the only one within five miles of the LACBWR site.

2.3 HISTORIC AND ARCHEOLOGICAL SITES AND NATURAL LANDMARKS

The National Register of Historic Places through February 1976 lists no archeological or historical sites in Vernon County. The listed site closest to the LACBWR is the Emmanuel Evangelical Lutheran Church in Brownsville, Minnesota, nine miles NNW of the plant. A letter from the State Historical Society of Wisconsin is included as Appendix B. None of the archeological sites identified are in the same section of land as LACBWR and, hence, no impact would be expected.

The State of Wisconsin has placed three historical markers along Highway 35 in Vernon County. One is about a half mile north of the LACBWR, overlooking the Federal Lock and Dam. It describes the origin of the present system of locks on the Upper Mississippi. The second, about 7.5 miles

south of the plant, commemorates the Battle of Bad Axe. The third is adjacent to the LACBWR and commemorates the plant itself as Wisconsin's first nuclear generating plant.

2.4 GEOLOGY

Geology is discussed only briefly and descriptively, because the intent is to provide background only for potential environmental impact. The detailed discussion pertaining to safety aspects of site geology will be covered in the Final Safety Analysis Report of the Systematic Evaluation Program to be completed by the staff about 1982.

2.4.1 Stratigraphy

The LACBWR site is underlain by rocks of Cambrian and Quaternary age. East of the site, the Cambrian formations are overlain by additional Cambrian and Ordovician formations that comprise the bluffs.

The oldest geologic unit of particular interest at the site is the Mount Simon Sandstone. Other formations overlie the Mount Simon in the following order (oldest to youngest): the Eau Claire, Galesville, and Franconia Sandstones, and the Trempealeau Formation. These are flat-lying, coarse-grained dolomitic sandstones, containing some shale and dolomite beds. The Eau Claire and Franconia are commonly shaley.

The geology of the valley fill in the vicinity of the reactor site is known from the records of water wells and foundation borings at Genoa 1. The logs of foundation borings indicate that below a 17- to 20-foot layer of fill the alluvium consists of one or two feet of dark gray silty clay underlain by fine to medium gray silty sand with occasional small to medium gravel. No information is available on the mineralogic composition of the alluvium. Material that is locally derived can be reasonably assumed to consist largely of quartz sand. The alluvium probably has a low capacity for the uptake of radionuclides by ion exchange and absorption.

Based on records in the Engineering Department of DPC, the valley fill at the reactor site may be somewhat thinner than in some nearby areas. A water well at Genoa 1 is reported to be bottomed in sandstone at a depth of about 100 feet. Two other wells at Genoa 1 are about 150 feet deep and one is uncased below 100 feet, so it is presumably finished in sandstone rather than alluvium.

2.4.2 Seismicity

The influence of the geology of a site on the response of sturcture to earthquake shock is well known. Alluvial materials tend to accentuate shortperiod vibrations, and alluvium containing beds or appreciable amounts of sand, silt, and clay may respond by sudden differential compaction which could result in tilting of structures. Loose cohesionless material may densify during seismic loading. Data from LACBWR indicate that previous evaluations of liquification considerations may not have been sufficient. The staff has determined that remedial measures are required, and DPC has submitted a new analysis for staff review.

2.5 HYDROLOGY

In the reach between La Crosse, Wisconsin, and Lansing, Iowa, the Mississippi Valley is relatively straight and trends almost due south. The valley floor is made up of marshy land consisting of islands between river channels and extensions of a low-lying floodplain cut by sloughs, ponds, and meandering stream channels. The valley walls rise sharply to the upland, 500 to 600 feet above the level of the river. Tributary streams have cut numerous short, steep-sided valleys (coulees) into the flat to gently rolling upland surface. Interstream drainage divides consist of narrow, winding ridges.

The main channel of the river ranges greatly in width both above and below the reactor site. Between Dam No. 8 and the site, the river is 1500 to 2000 feet wide. Above the dam, the river is nearly four miles wide where impounded water covers the floodplain. Below the site, the main channel is relatively narrow for some 20 miles, then gradually widens toward Dam No. 9 as it covers a larger part of the floodplain. Streamflow conditions are greatly influenced by these two dams, which are part of a series of dams built and operated by the U.S. Army Corps of Engineers for navigational purposes.

2.5.1 Magnitude and Duration of Low Flow

Low flow at the site occurs in the fall and winter; the lowest monthly average flow is most frequently recorded in February. In periods of drought, minimum flows have also occurred in August and September.

Flows, based on 42-year records of the U.S. Geological Survey at the Winona gaging station, are given in Table 2.5-1.

Table 2.5-1. Flows at Winona Gaging Station

	Flow (cfs)
42-yr average	25,260
42-yr maximum	268,000 (4/19/65)
42-yr minimum	2,250 (12/33)
January average	12,700
July average	27,200
7-day, 10-year low	5,700

From the ER.

2.5.2 Groundwater

Information on four domestic wells south of the LACBWR and east of Highway 35 indicates that the water table is near the surface and that the gradient is toward the river. The locations of the wells are shown in Fig. 2.1-1. Depths of water range from 20 to 45 feet below the land surface. The elevation of the water table above mean sea level ranges from about 640 feet in the area southeast of the LACBWR to about 620 feet a mile south of the plant. The yield of each of the four wells is about 10 gpm.

Chemical characteristics of shallow groundwater at the site, determined from analysis of water from two LACBWR supply wells, are shown in Table 2.5-2. Both wells are located in Lot 7, in the southern portion of the DPC Genoa property.

The chemical constituents of the shallow groundwater are not greatly different from those of the river water. However, the groundwater is considerably harder than the river water. The wells are finished in sandstone, but they are relatively shallow (casing depths of 92 and 129 feet) and apparently do not penetrate the artesian aquifer.

2.5.3 Quality of River Water

Table 3.7-1, found in Section 3.7, lists values for intake water quality parameters as recorded on Corps of Engineers permit application documents.

2.5.4 Site Drainage

The LACBWR site is favorably located with respect to drainage from the hills to the east because of two short valleys east of the bluff along Highway 35, one draining north toward Genoa, and one south below the reactor site. For all practical purposes the site is level. The two valleys limit the hill area that contributes runoff across the site and only the precipitation that falls on the bluff and a small upland area can cross the site. This drainage is channeled along the highway and railroad to prevent interference with traffic. A small amount of other drainage from the railroad right-of-way and nearby hills is channeled to the river via three underground culverts.

Table 2.5-2. Analysis of Water from LACBWR Supply Wells (ppm except pH and color)

Parameter	Well No. 3	Well No. 4
pH @ 25°C	7.7	7.7
Alkalinity (HCO_3)	340	337
Sulfate (SO_4)	15	10
Chloride (Cl)	8	7
Nitrate (NO_3)	5	5
Silica (SiO_2)	15	15
Phosphate, ortho (PO_4)	0.2	0.2
Phosphate, meta (PO_4)	<0.1	<0.1
Hardness (as $CaCO_3$)	294	302
Calcium (Ca)	65	65
Magnesium (Mg)	32	34
Iron (Fe)	0.05	0.08
Manganese (Mn)	<0.03	<0.03
Color (APHA units)	0.5	0.5
COD	1	1
Suspended solids (est.)	5-10	5

From the ER.

2.6 METEOROLOGY

2.6.1 Regional Climatology

Southwestern Wisconsin has a continental climate typical of the interior of North America and characterized by a large annual range of temperature and frequent short-period temperature changes. Continental polar air, of Canadian origin, is the predominant air mass over the region throughout the year, although in summer maritime tropical air from the Gulf of Mexico and continental tropical air from the southwestern desert occasionally penetrate northward into the area. Winters are long and cold and summers short and warm, while the other two seasons are relatively brief transition periods between summer and winter.

On 16 days annually, temperatures may be expected to reach 90°F or higher.[1] Temperatures of 32°F or lower normally occur on 152 days annually and temperatures of 0°F or below on 27 days.[1] Precipitation is at a maximum in summer and a minimum in winter, averaging about 29 inches annually.[1] In the summer, precipitation occurs mainly in thundershowers and in winter mainly as snow associated with large-scale storm systems. Over one-half of the annual precipitation normally occurs during the period May through September.[1]

Large-scale, cyclonic storms (lows) and anticyclones (highs) frequently move along preferred tracks that cross southwestern Wisconsin during autumn, winter, and spring. The successive passing of these weather systems is responsible for the short-period variability in the region's weather. In the summer, these tracks are displaced northward, which tends to reduce the changeability of the weather. Relative humidity normally averages 72% annually.[1]

2.6.2 Local Meteorology

The plant site is on the east bank of the Mississippi River, 17 miles south of La Crosse, Wisconsin. The site is within the river valley, which is about two and one-half miles wide in the vicinity of the plant. The eastern wall of the valley is approximately 1000 feet east of the plant, with the top about 500 feet above the level of the river (ER, Sec. 2). The steep sided valley affects local meteorological conditions by channeling the wind so that the predominant wind directions are oriented along the axis of the valley. At night, cold air drains down the valley walls and collects on the valley bottom, resulting in a relatively high frequency of inversion conditions and fog formation within the valley.

Data from the National Weather Service station at La Crosse Municipal Airport, which is also in the Mississippi River Valley 19 miles north of the site, show that mean monthly temperatures range from 16°F in January to 73°F in July.[1] An extreme maximum temperature of 108°F was recorded in July 1936 and an extreme minimum temperature of -43°F in January 1873.[1]

Precipitation records from La Crosse indicate a normal annual total of 29.1 inches, with July having the highest normal monthly total of 4.4 inches and February the lowest monthly total of 0.9 inch.[1] The maximum 24-hour rainfall amount recorded at La Crosse is 7.2 inches in October 1900.[1] Annual snowfall at La Crosse averages 42.2 inches, with the maximum 24-hour total of 15.7 inches recorded in March 1959.[1] Heavy fog (visibility one-fourth mile or less) occurs on an average of 21 days annually.[1]

Wind data from La Crosse Airport show that the predominant wind direction is from the south with a frequency of 14.2%, while winds from the northwest occur 11.8% of the time. (Fig. 2.6-1) This reflects the channeling effect of the valley which is oriented north-south to the south of the station and northwest-southeast north of the airport. Data collected at the site during the period 1978-1979 indicate that winds from the south-southeast are predominant with a frequency in excess of 20%. Winds from the north are the next most frequent, occurring 18% of the time. The north-south orientation of the valley in the vicinity of the plant is responsible for this wind frequency distribution (Tables 2.6-1 and 2.6-2). The differences in wind frequency distribution between the La Crosse Airport and the LACBWR site require adjustment in analysis of the latter.[2,3]

2.6.3 Severe Weather

Severe weather occurrences at this site are mainly associated with intense, large-scale winter storm systems or severe thunderstorms. Seventeen tornadoes were reported within the one-degree longitude-latitude square containing the site during the period 1955-1967, giving a mean annual tornado frequency of 1.3 and a recurrence interval for a tornado at the plant site of 960 years.[4,5]

There were 17 reports of hail three-quarters of an inch in diameter in the square during this period and 37 reports of windstorms with wind speeds of 50 knots (58 mph) or greater.[4] The highest "fastest mile" wind speed recorded at La Crosse is 69 mph in October 1949.[1]

Thunderstorms may be expected to occur on 41 days annually and freezing rain or drizzle on six days.[2,5]

2.7 BIOTA

The LACBWR is situated on the eastern bank of Pool 9 about a half mile below Lock and Dam No. 8. The pool is included in the 194,000-acre Upper Mississippi River Wild Life and Fish Refuge, which extends from Wabasha, Minnesota, to Rock Island, Illinois, a distance of 284 miles.

Fourteen areas designated as wildlife sanctuaries have been established at intervals along the river. They total approximately 41,000 acres, which are closed for protection of migratory waterfowl during the hunting season. The LACBWR is 1.6 miles south of one sanctuary area, which extends upstream for about eight miles on the west side of the main channel. On the east, or Wisconsin side of the river, about 11.5 miles north of the LACBWR is another sanctuary. The next sanctuary downstream is near Lynxville, about 23 miles downriver.

From 1965 through 1977, day use of Pool 9 by waterfowl ranged from a low in 1968 of 2,246,975 to a high in 1977 of 8,637,140 waterfowl days. Annual harvests of waterfowl in the pool for 1965 through 1971 ranged from 570 to 1451 birds with an average hunter bag rate of 1.62.

The Genoa National Hatchery, operated by the U.S. Fish and Wildlife Service, is located on the east side of the river 4.5 miles below the LACBWR. Northern pike, walleyes, largemouth bass, and bluegills, totaling approximately 1,500,000 annually, are propagated. Water to supply the hatchery is obtained from wells and the Bad Axe River.

To prepare the LACBWR site, 26.8 acres of bottomlands and shallows were filled with material dredged from the Mississippi River. The filled area was originally bottomland forested by hardwoods, and contained scattered potholes and marsh type habitats. The wooded area south of the plant site, intermixed with potholes, is a continuation of the habitat which was filled. In bottomlands adjacent to the site, white and green ash, elms, river birch, and cottonwoods comprise more than half the trees. The hillsides east of the site are covered by an oak type forest dominated by red, white, and black oaks.

Lists of the wildlife found in the Upper Mississippi River Valley are given in the applicant's Environmental Report (ER Tables 2.7-5, 2.7-6, and 2.7-7). Fish are quite abundant in the Upper Mississippi River, with 113 species recorded. A checklist of fish collected experimentally in the upper part of Pool 9 by Wisconsin Department of Natural Resources (DNR) biologists is presented

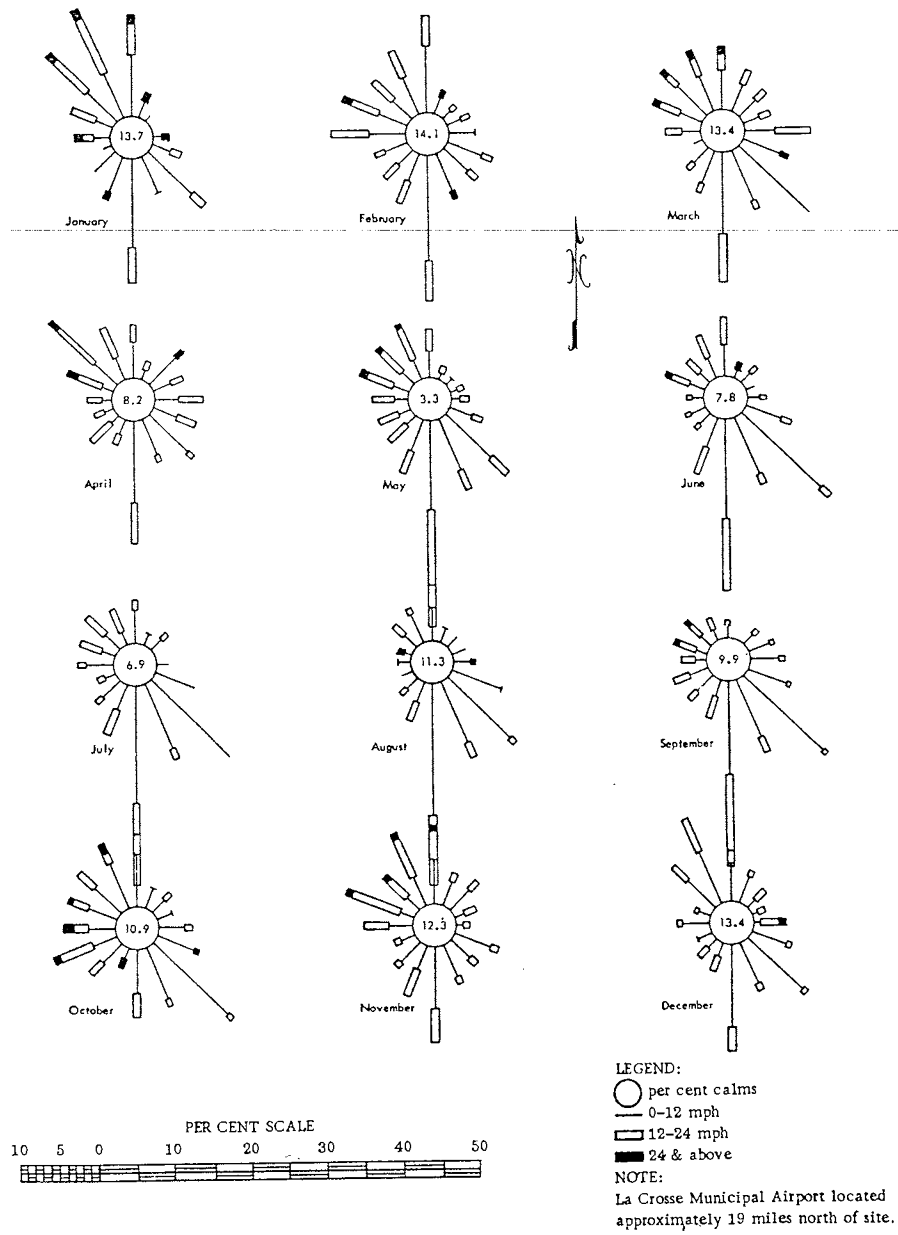

Fig. 2.6-1. Yearly Variation in Surface Winds at La Crosse Municipal Airport. From the ER.

TABLE 2.6-1. Joint Frequency Distribution for LACBWR 105 Meter Level for 1978

Wind Direction	Wind Speed (MPH) 0-3	4-7	8-12	13-18	19-24	>24	Percent Total
N	*2.03	4.01	4.65	3.47	1.36	1.93	17.45
NNE	.81	1.21	.70	.64	.06	.01	3.43
NE	.52	.59	.35	.34	.08	.03	1.91
ENE	.50	.63	.58	.26	.03	.03	2.03
E	.50	.63	.50	.27	.02	.00	1.92
ESE	.87	1.06	.99	.66	.32	.65	4.55
SE	1.40	2.47	3.74	2.04	.39	.36	10.40
SSE	2.68	6.03	7.21	4.63	1.27	1.02	22.84
S	1.10	1.99	1.53	.58	.35	.41	5.96
SSW	.59	1.04	.49	.13	.01	.06	2.32
SW	.42	.60	.31	.07	.03	.02	1.45
WSW	.42	.71	.55	.18	.05	.05	1.96
W	.50	.69	1.02	.44	.10	.10	2.85
WNW	.86	1.40	1.04	.32	.15	.23	4.00
NW	1.05	2.01	2.32	1.12	.69	.51	7.70
NNW	1.45	2.06	2.62	.71	.31	.32	7.47
Calm	1.30						
Percent Total	17.00	27.13	28.60	15.86	5.22	5.73	100.00

*2.03 = 2.03%

TABLE 2.6-2. Joint Frequency Distribution for
LACBWR 105 Meter Level for 1979

Wind Direction	Wind Speed (MPH)						Percent Total
	0-3	4-7	8-12	13-18	19-24	>24	
N	*1.88	3.39	4.56	4.37	2.17	2.14	18.51
NNE	.77	1.00	.61	.08	.00	.00	2.46
NE	.41	.54	.09	.01	.01	.00	1.06
ENE	.56	.70	.24	.04	.01	.00	1.55
E	.58	.82	.47	.09	.01	.00	1.97
ESE	.65	1.18	.92	.66	.47	.21	4.09
SE	1.13	2.24	3.61	3.43	1.01	.29	11.71
SSE	1.30	3.96	5.47	5.20	2.48	1.03	19.44
S	.91	1.75	1.56	1.10	.33	.21	5.86
SSW	.56	1.20	.80	.23	.08	.00	2.87
SW	.30	.65	.42	.14	.00	.00	1.51
WSW	.39	.61	.48	.28	.04	.00	1.80
W	.49	.80	.96	.66	.08	.00	2.99
WNW	.63	1.00	1.37	.66	.01	.06	3.73
NW	1.02	2.16	3.11	2.01	.17	.04	8.51
NNW	1.78	2.44	2.70	2.82	.63	.43	10.80
Calm	.73						
Percent Total	14.09	24.44	27.37	21.78	7.50	4.41	100.00

*1.88 = 1.88%

corrections made per Errata sheet issued 8/27/82 kh

here in Table 2.7-1. Creel census data for Pool 9 is limited, but Iowa Conservation Commission personnel estimated for 1967 that 330,550 sport fish were caught in 320,000 hours of fishing by 65,000 anglers.

The catch rate is 1.03 fish per hour. Catches of crappie, bluegill, drum, largemouth bass, and sauger were 140,000, 80,000, 40,000, 20,000, and 12,000, respectively, in 1967. For the years 1965 through 1978 annual commercial catches by Wisconsin fishermen in Pools 8 and 9 have ranged from ~~886,595~~ 1,824,217 to ~~1,485,637~~ 1,629,499 pounds with carp comprising approximately 50% of the catch (Table 2.7-2).

2.7.1 Endangered Aquatic Species

The U.S. Department of the Interior has listed the Higgins' pearly eye mussel (*Lampsilis higginsi*), which is found in the vicinity of the plant, as endangered. The State of Wisconsin lists this mussel as well as ten species of fish, a frog, and a turtle as either threatened or endangered (Table 2.7-3).

Table 2.7-1. Species, Composition, and Relative Abundance in Fish Samples Taken by Electrofishing at Three Locations Below Dam No. 8 for Five Sampling Periods in 1961

Fish Species[a]	Immediately Below Dam No. 8 No.	%	Above Bad Axe River Mouth No.	%	Below Bad Axe River Mouth No.	%
Bluegill	54	18	29	5	11	3
Black crappie	43	14	23	4	39	11
White crappie	28	9	1	-	11	3
White bass	42	14	392	66	38	11
Walleye	3	1	5	1	10	3
Carp	38	13	59	10	160	44
Smallmouth buffalo	4	1	1	-	3	1
Northern pike	2	1	1	-	1	-
Largemouth bass	18	6	22	4	10	3
Smallmouth bass	2	1	6	1	2	1
Quillback	17	6	2	-	1	-
Sauger	6	2	4	1	5	1
Silver redhorse	6	2	7	1	9	3
Northern redhorse	7	2	27	5	16	4
River carpsucker	1	-	-	-	5	1
Freshwater drum	1	-	4	1	14	4
Plains carpsucker	20	7	4	1	6	1
Bigmouth buffalo	1	-	-	-	-	-
Channel catfish	1	-	-	-	6	1
Golden redhorse	3	1	-	-	8	2
Longnose gar	1	-	-	-	1	-
Bowfin	-	-	-	-	5	1
Mooneye	-	-	2	-	1	-
Lamprey	-	-	1	-	-	-
Pumpkinseed	-	-	1	-	-	-
Yellowbass	-	-	5	1	-	-
Yellow perch	-	-	1	-	-	-
Total	298	98	598	101	362	99

[a]Data provided by the Wisconsin Department of Natural Resources.

Source: R. C. Hubley, Jr., "Mississippi River Electrofishing in Pools 9, 10, 11 and 12 during 1971." Investigational Memorandum No. 15, Wisconsin Conservation Dept., Fish Management Division.

Table 2.7-2. Commercial Fish Catch on the Wisconsin Side of the Mississippi River from 1965 Through 1978 in Pools 8 and 9 (pounds)

Year	Pond 8	Pond 9
1965	860,506	963,711
1966	790,769	941,670
1967	860,265	998,461
1968	679,758	886,595
1969	553,622	1,009,014
1970	782,864	1,485,637
1971	1,019,762	1,215,890
1972	1,065,735	983,349
1973	798,834	1,169,296
1974	658,837	1,460,278
1975	673,478	744,931
1976	1,018,642	763,262
1977	1,159,553	451,659
1978	1,044,158	585,341

Source: Wisconsin Department of Natrual Resources, Bureau of Fish and Wildlife Management.

Table 2.7-3. Threatened and Endangered Aquatic Biota of the LACBWR Vicinity

Major Group	Species		Status
	Common Name	Scientific Name	
Reptiles	Wood turtle	*Clemmys insculpta*	Endangered - WI
Amphibians	Pickerel frog	*Rana palustris*	Threatened - WI
Fishes	Crystal darter	*Ammocryta asprella*	Endangered - WI
	Bluntnose darter	*Etheostoma chlorosomum*	Endangered - WI
	Goldeye	*Hiodon alosoides*	Threatened - WI
	Speckled chub	*Hybopsis aestivalis*	Threatened - WI
	Pallid shiner	*Notropis amnis*	Threatened - WI
	Blue sucker	*Cycleptus elongatus*	Threatened - WI
	Black buffalo	*Ictiobus niger*	Threatened - WI
	River redhorse	*Moxostoma carinatum*	Threatened - WI
	Mud darter	*Ethoeostoma asprigene*	Threatened - WI
	Pugnose shiner	*Notropis anogenus*	Threatened - WI
Molluscs	Higgins' pearly eye mussel	*Lampsilis higginsi*	Endangered - WI and U.S.

A mussel survey of Thief Slough was conducted by the applicant in 1978.[7] No Higgins' pearly eye mussels were found, although the study reported the habitat favorable for mussels. The other 12 species considered threatened or endangered by the State of Wisconsin were not surveyed; however, some of the fishes from the State list were observed during other aquatic studies. The most common reason for the longer State listing of endangered or threatened species is that the additional species are at the northern or southern boundary of their ranges and are rare only in these extreme areas. This is the case for the majority of the State listed fishes.[8]

2.7.2 Endangered Terrestrial Species

Several plant and animal species known to occur in the Upper Mississippi River Wildlife and Fish Refuge are included in the Wisconsin lists of endangered and threatened species.[9] Whether or

not any of these species existed on the site before construction is unknown, as no preconstruction surveys were made.[10] However, it is unlikely that any mobile, sensitive species were present because of the intensive human activity in the area: Genoa 1 was in operation just to the north of the site and a commercial fishing camp was operating just south of the site. There are now two nesting pairs of bald eagles on the west side of the river, one to two miles from the site, and a heron and egret rookery, also on the west side of the river, about two miles south.[10]

In view of the fact that the plant has been in operation for a number of years, the Fish and Wildlife Service foresees no adverse impacts on any endangered species as a result of plant operations (letter dated January 24, 1980 to Ronald L. Ballard from Charles A. Hughlett).

2.8 BACKGROUND RADIOLOGICAL CHARACTERISTICS

Baseline radiological data were obtained for the LACBWR site and environs during several years prior to plant operation. Samples were taken of air, precipitation, river water, groundwater, river silt, soil, vegetation, milk, fish, and animals, and analyzed for radioactivity. The types of samples, analyses, and minimum detectable activity for each are shown in Table 2.8-1. The results of the preoperational survey from April 1965 to April 1966 are reported by the applicant (ER Tables 2.8-2 through 2.8-13) and are representative of background levels.

The locations of the monitoring stations are shown in Fig. 2.8-1.

A terrestrial radiation survey was conducted during July 1968 for a square centered about the LACBWR site and measuring 25 nautical miles on each side. The Aerial Radiological Measuring System (ARMS) was used to collect gross gamma spectral data at a flight level of 300 feet above the terrain. Exposure rates three feet above the ground were determined from the gross counts to range from 2 to 10 microroentgens per hour (μR/hr). These exposure rates may be converted to roughly 18 and 88 mR/yr and are typical of the range of background radiation levels found throughout the United States. The 2 to 4 μR/hr exposure contours are due primarily to cosmic radiation and conform closely to the boundaries of the Mississippi River. The gamma spectral analyses indicated only natural background radiation.

Table 2.8-1. Preoperational Radiological Survey Samples Analyses and Sensitivities

Type Sample	Analysys	Sensitivity Detection Limit	Aliquot to be Analyzed
Air particulate	Beta-Gamma	2×10^{-3} pCi/m	10,800 ft^3 [a]
Rain water	Beta-Gamma	5 pCi/l	500 ml
River WAter	Beta-Gamma (susp)	5 pCi/l[b]	500 ml
	Alpha (susp)	0.5 pCi/l[b]	500 ml
	Beta-Gamma (diss)	5 pCi/l	500 ml
	Alpha (diss)	0.5 pCi/l	500 ml
	Sr-90	0.5 pCi/l	1,000 ml
	Cs-137	1.0 pCi/l	1,000 ml
Tap water	Beta-Gamma	5 pCi/l	500 ml
	Alpha	0.5 pCi/l	500 ml
Well water	Beta-Gamma	5 pCi/l	500 ml
	Alpha	0.5 pCi/l	500 ml
River silt	Beta-Gamma	2 pCi/g[c]	1 g
	Alpha	1 pCi/g[c]	1 g
	Sr-90	0.1 pCi/g[c]	10 g
	Cs-137	0.2 pCi/g[c]	10 g
Soil	Beta-Gamma	2 pCi/g[c]	1 g
	Alpha	1 pCi/g[c]	1 g
Vegetation	Beta-Gamma	0.5 pCi/g[d]	1 g
Fish	Beta-Gamma	0.5 pCi/g	10 g
	SR-90	0.005 pCi/g	100 g
	Cs-137	0.01 pCi/g	100 g
Animal	Beta-Gamma (carcass)	0.05 pCi/g	10 g
	Beta-Gamma (liver & kidney)	0.05 pCi/g	10 g
	Sr-90 (bone)	0.05 pCi/g[e]	10 g
	Cs-137 (carcass)	0.01 pCi/g	100 g
Milk	Cs-137	1.0 pCi/l	500 ml
	Sr-90	2.0 pCi/l	500 ml
	I-131	20.0 pCi/l	1,000 ml

[a] Based on a sample rate of 1 cu ft/min for one-week periods.

[b] Based on volume of water from which suspended solids originate.

[c] Based on dried (ignited) weight.

[d] Based on dried (28°C) weight.

[e] Error reported with sample is for one sigma counting statistics. Error listed in this column is that for overall procedure at ten times detection limit. For gross procedures, the error due to variation in nuclides present from the standard used has been considered on an average rather than for extreme possibilities.

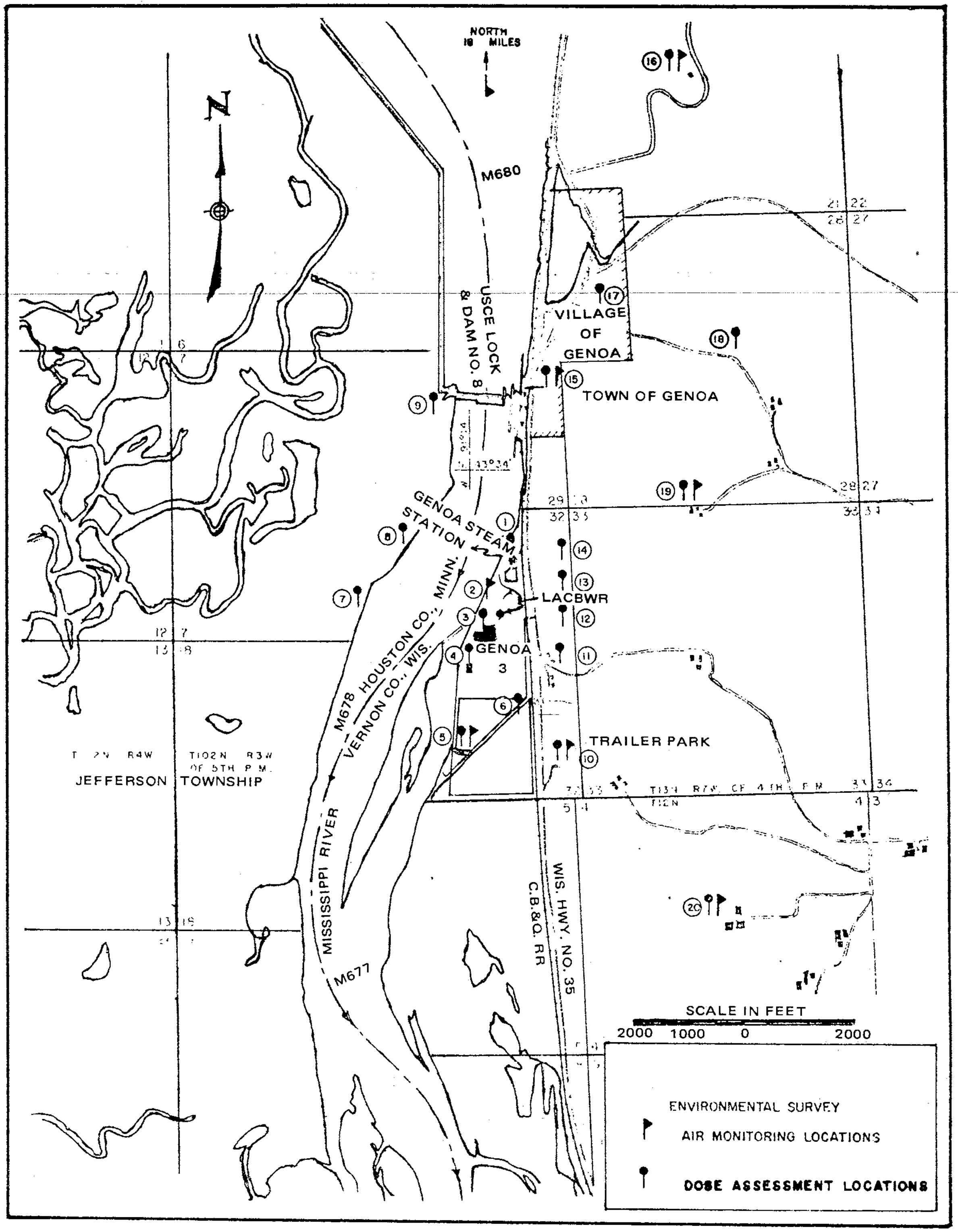

Fig. 2.8-1. Environmental Survey Air Monitoring and Dose Assessment Stations. From the ER.

References

1. "Local Climatological Data, Annual Summary with Comparative Data--La Crosse, Wisconsin," Environmental Data Service, U.S. Dept. of Commerce, published annually through 1972.

2. J.F. Sagendorf and J.T. Goll, "XOQDOQ-Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations," U.S. Nuclear Regulatory Commission, September 1977.

3. "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Cooled Reactors," U.S. Nuclear Regulatory Commission, Regulatory Guide 1.111, Rev. 1, July 1977.

4. "Severe Local Storm Occurrences, 1955-1967," ESSA Tech. Memo. WBTM FCST 12, SELS Unit Staff, National Severe Storms Forecast Center, Office of Meteorological Operations, Silver Spring, MD, 1969.

5. H.C.S. Thom, "Tornado Probabilities," Monthly Weather Review, October-December 1973, pp. 730-737.

6. I. Bennett, "Glaze - Its Meteorology and Climatology, Geographical Distribution, and Economic Effects," Tech. Report EP-105, Headquarters, Quartermaster Research and Engineering Command, U.S. Army, Natick, MA, 1959.

7. George L. Johnston, "Mussel Survey of Thief Slough at Mile 678 on the Mississippi River near Genoa, Wisconsin, September 21 and 22, 1978," report for Dairyland Power Cooperative, 11 pp. and appendix, undated.

8. Samuel Eddy and James C. Underhill, "Northern Fishes," University of Minnesota Press, Minneapolis, 3rd Ed., 414 pp., 1974.

9. Wisconsin Endangered and Threatened Species Lists Pursuant to Administrative Code Revision (NR 27) Effective June 12, 1979, Dept. of Natural Resources, State of Wisconsin, Madison.

10. Responses to Questions, Thomas A. Steele in letter to Ronald L. Ballard, U.S. Nuclear Regulatory Commission, December 12, 1979.

3. THE PLANT

3.1 EXTERNAL APPEARANCE

The principal structures comprising the LACBWR are the containment building, the turbine building, the service building, and the stack (Fig. 3.1-1). The containment building, which resembles a large silo, is a vertical concrete cylinder capped by a steel dome. It is 60 feet in diameter and 128 feet high, with an additional 16 feet below grade.

The turbine building, immediately west of the containment building, is 75 feet wide, 110 feet long, and 63 feet high. Its north wall is shared by the service building, which is 30 feet wide, 110 feet long, and 63 feet high. The turbine and service buildings form a single architectural unit sheathed in unpainted corrugated aluminum with the main facade--the front of the service building--on the north. The service building facade resembles that of a conventional three-story office building.

Just east of the containment building is the LACBWR's 350-foot free-standing concrete stack. The LACBWR appears small in relation to Genoa 3, whose turbine building is 205 feet high and which has a 500-foot stack (Fig. 3.1-2).

Just north of the LACBWR, opposite the service building entrance, is a recently constructed security building that measures 64 feet by 120 feet. This two-story structure is of masonry construction with an architecturally decorative exterior wall. The parking lot for approximately 60 cars is just east of the security building.

The developed portions of the DPC property, excluding the boat-launch facility and its access road, are enclosed by an eight-foot cyclone fence.

3.2 TRANSMISSION LINES

Approximately 160 feet northwest of the LACBWR is a self-supporting, lattice-type transmission tower, 185 feet high. It supports a 161-kV transmission line running to a similar tower on the west shore of the Mississippi. Between the LACBWR and Genoa 1 is a switchyard approximately 600 feet long and 220 feet wide, containing 34.5-kV, 69-kV, and 161-kV switchgear. The LACBWR substation is connected to the switchyard by a 69-kV transmission line approximately 1000 feet long. This is the only transmission line constructed for the LACBWR, whose power is delivered to the DPC system via transmission facilities previously constructed.

3.3 REACTOR AND STEAM-ELECTRIC SYSTEMS

3.3.1 <u>General Description</u>

The LACBWR is a nuclear power plant of nominal 52-MWe capacity. Its heat source is a forced-circulation, direct-cycle, boiling-water reactor. The reactor operates at a pressure of 1300 psia and produces 165 MWt. The design gross electrical output of the turbine-generator is 55.9 MWe. With an auxiliary load of 3.5 MWe, the net electrical output is 52.4 MWe and the net cycle efficiency is 31.8%. The current (1980) output is 46 MWe.

3.3.2 <u>Reactor and Fuel</u>

In the first core, uranium enriched to 3.6% in uranium-235 was used. Second core enrichment was 3.9%. The spent fuel pool storage capacity was enlarged from 84 to 134 assemblies in 1976 and application was made in 1978 to enlarge the capacity to 440 assemblies. Neither enlargement involved construction outside of the present spent fuel pool. In January 1980 the ASLB, in an initial decision, granted permission to enlarge the pool. Further information on the fuel pool is contained in Appendix D.

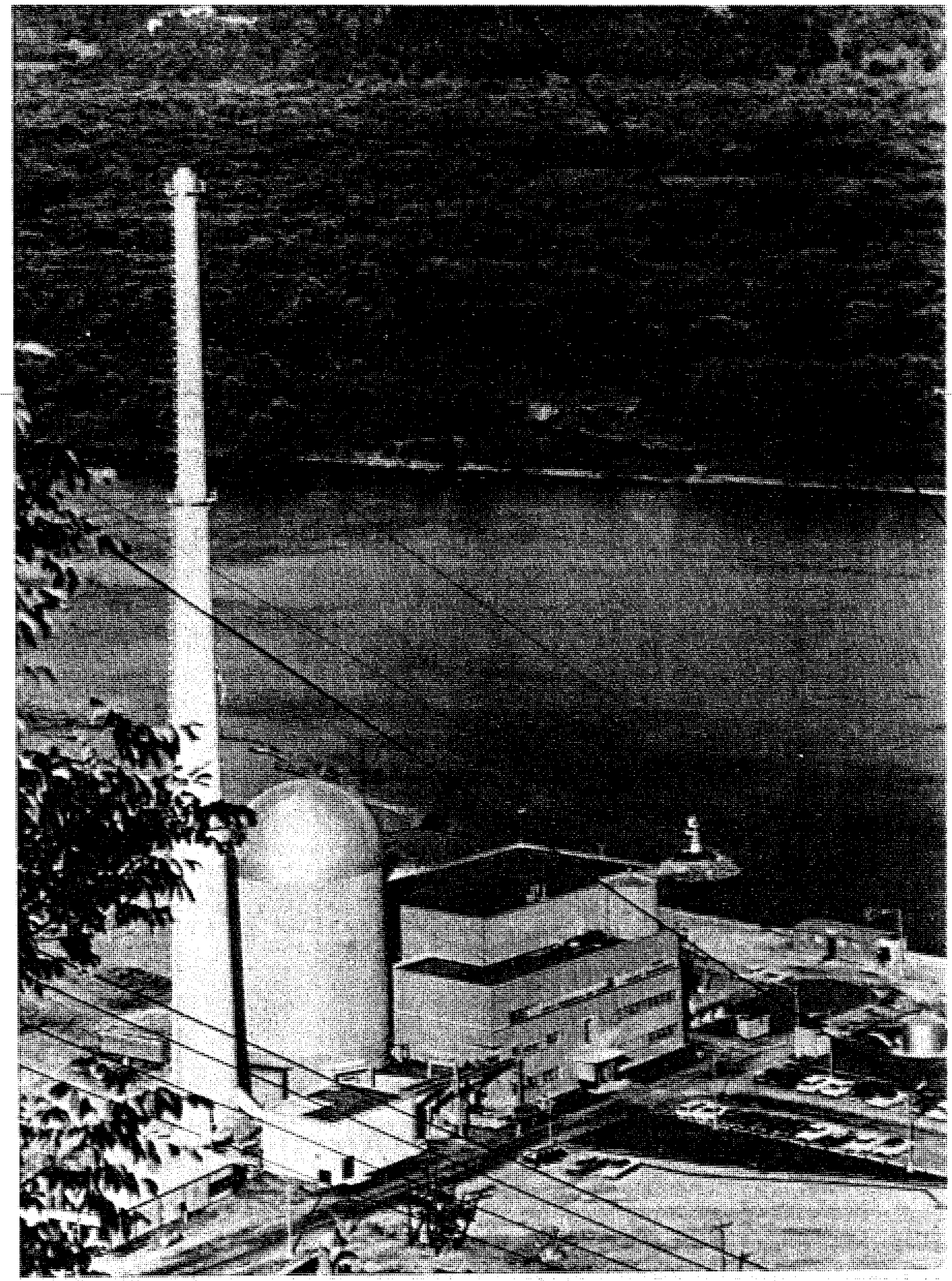

Fig. 3.1-1. The La Crosse Boiling Water Reactor Nuclear Power Plant. From a color print in the ER.

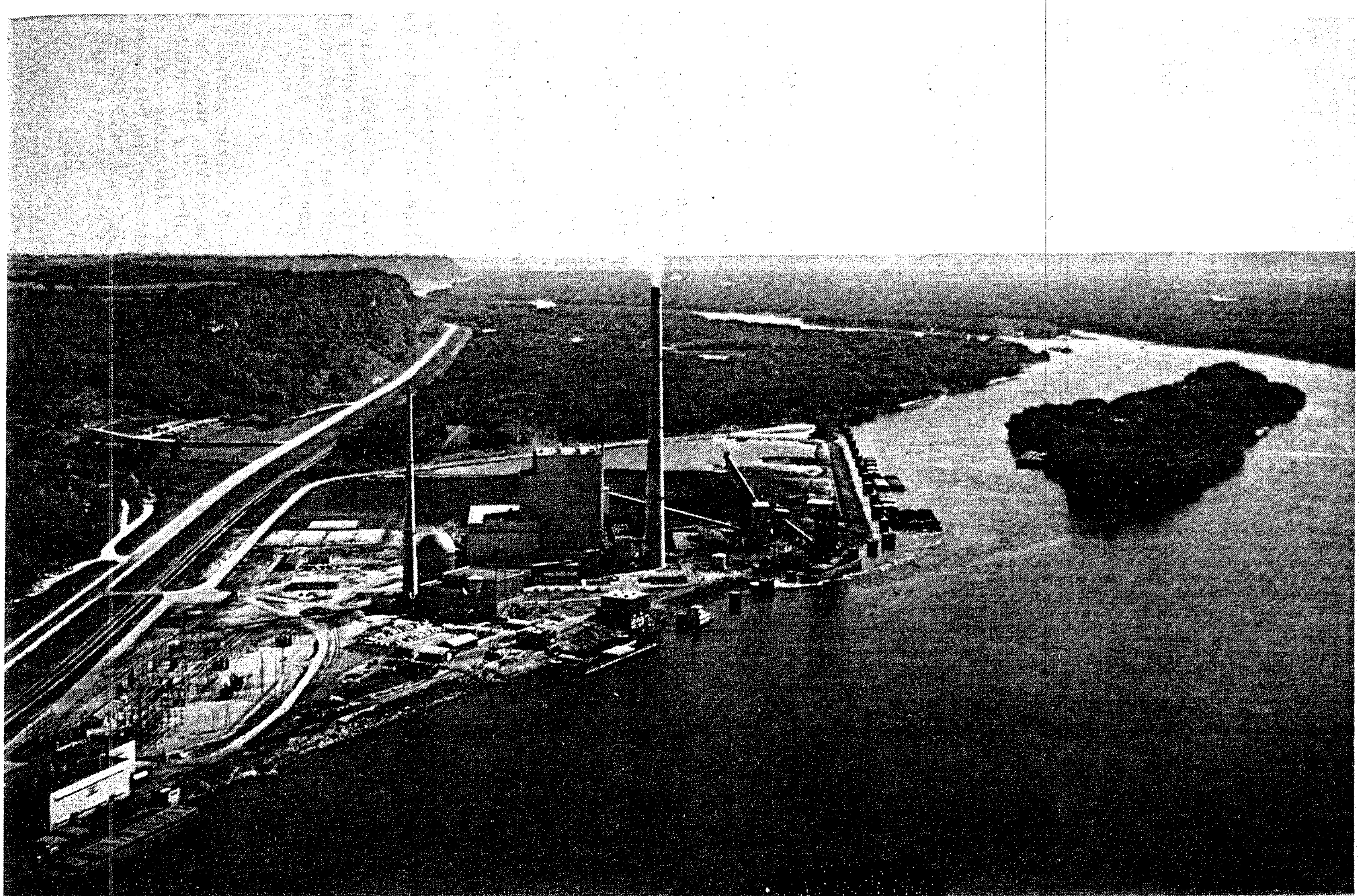

Fig. 3.1-2. Upstream View of LACBWR and Genoa 3. Note the angular pattern extending from Island 126 toward the power complex. This is caused by a submerged closing dam. During lower water flows, water enters the mouth of the dam along the site shore instead of flowing over the dam. For all flow conditions effluents flow into the area to the right of the plant which is Thief Slough. From a color print in the ER.

3.3.3 Condenser

The condensing equipment includes a 70,000-ft^2 two-pass, divided water box surface condenser. It is rated at 4.23 × 10^8 Btu per hour with a circulating water flow of 62,600 gpm at 60°F inlet temperature. There are two 32,000-gpm circulating water pumps; two 1500-gpm condensate pumps; full-flow condensate demineralizers; a motor-driven dry vacuum pump; and a steam-jet air ejector. The vacuum pump is used during startup and the steam-jet air ejector is used during normal operation. The condenser is supplied with circulating water from two pumps in the crib-house inlet at the river. The water is discharged downstream of the crib house.

3.3.4 Off-Gas System

Noncondensable gases removed from the condenser by the air ejector are normally discharged through a series of holdup tanks as shown in Fig. 3.6-2. In addition to the holdup tanks are absolute filters and charcoal absorbers which remove particulate material and iodines before the off-gases are routed to the stack. These holdup tanks provide for approximately ten hours of holdup at full power operation.

3.4 WATER USE

Cooling water is taken from and returned to the Mississippi River after passage through the once-through cooling system. Two wells located within the site boundaries provide water for other plant needs. Figures 3.4-1 and 3.4-2 are water-use diagrams for the stations showing major plant usage. The individual water supply systems for the plant are discussed in the following subsections.

3.4.1 Well Water System

3.4.1.1 Well Water Supply

Wells supply water to the plant and office for sanitary and drinking purposes, and to the generator wash-down stations. Water is used at personnel decontamination stations, three emergency showers, and two eyewash stations. It is used as cooling water for the two air conditioning units, in the heating boiler blowdown flash tank, and for the plant makeup demineralizer system.

Water is supplied from two deep wells. Well No. 4 is located 115 feet southeast of the containment vessel center and well No. 3 is located 205 feet northeast of this centerline. The wells are 12 inches in diameter, with eight-inch pump casings and piping. The upper 40 feet of casing are set in concrete. The sealed submersible pumps take suction through stainless steel strainers and discharge into pressure tanks.

3.4.1.2 Demineralized Water System

To provide chemically pure water for various plant uses, the system includes facilities for demineralizing, storing, and distributing the water as well as appropriate instrumentation for monitoring purity, pressure levels, etc.

Well water enters the makeup demineralizer through an isolation valve and an integrating flowmeter. The meter will alarm the control room when a preset number of gallons has passed through.

From the meter, water enters the top of the cation resin tank through a stainless-steel mesh distribution header which is fine enough to catch any resins and prevent them from entering the water systems. The water then flows down through the cation resin bed, out the bottom through an outlet header, and enters the top of the decarbonator through a level-control valve which regulates flow into the top of the column to maintain the desired level in the bottom tank portion.

Water entering the top of the column flows downward through a packed bed of plastic saddle-type packing. Air from a blower blows upward through the packed bed. The packing breaks up the water flow into a thin film-like spray, exposing the water to the blower air. The air scrubs the CO_2 out of the water. Air and CO_2 both pass up the stack to the roof. The water draining from the column collects in the bottom tank portion. Water is then pumped from the bottom of the decarbonator tank to the top of the anion tank. The water flows downward through the anion resin bed and out the bottom via two two-inch lines, one of which goes to the new water tank and the other to the condensate storage tank.

The condensate storage tank and the new water tank are actually two sections of an integral aluminum tank located on the office building roof. The lower section is the condensate storage

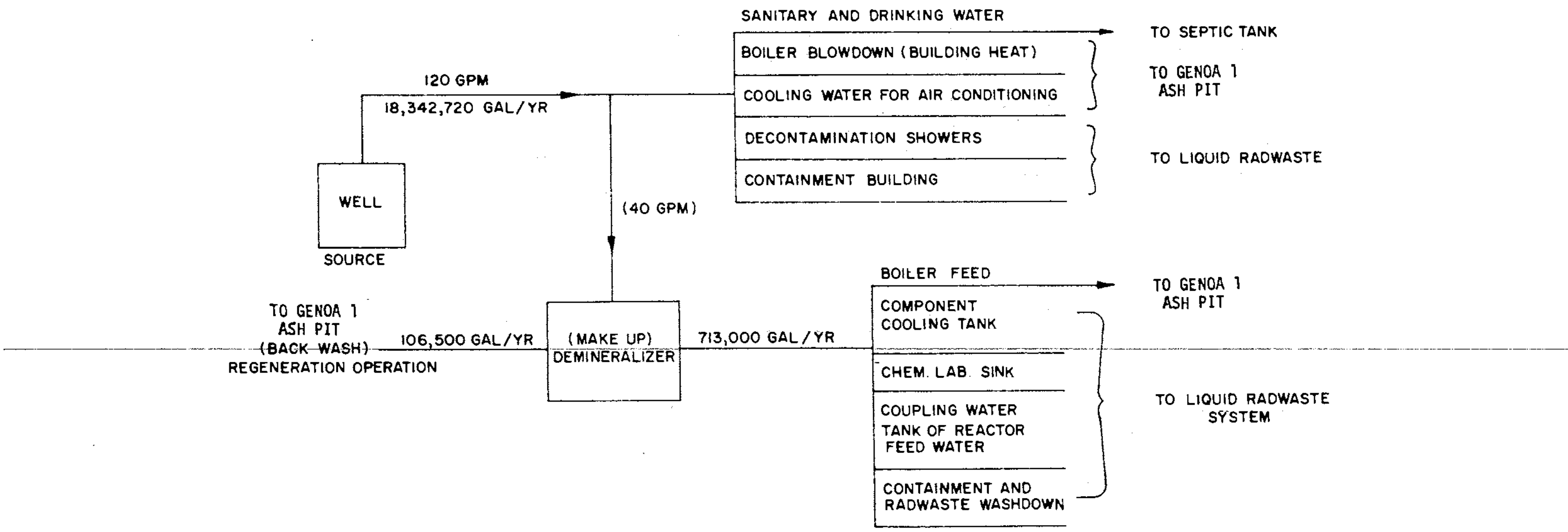

Fig. 3.4-1. Well-Water Use. (From Environmental Report Comments and Responses.)

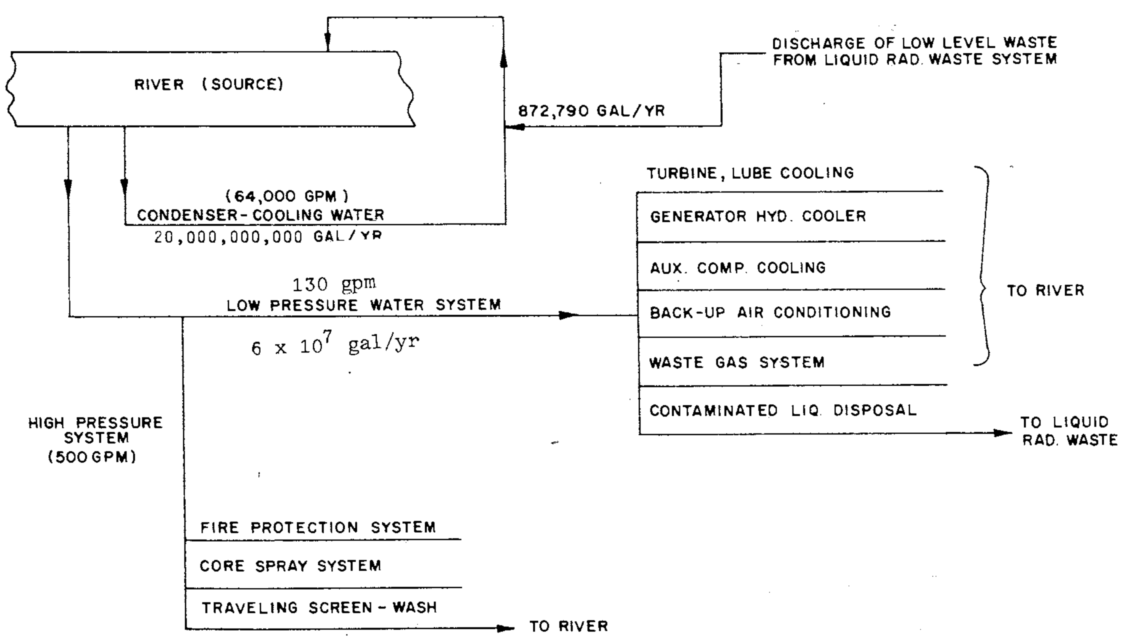

Fig. 3.4-2. River-Water Use. (From Environmental Report Comments and Responses.)

tank. It has a capacity of 19,100 gallons. The upper, or new water section holds 29,780 gallons. Both tanks have high and low level alarm protection, and each tank level is transmitted to and shown on level indicators in the control room.

3.4.2 Low-Pressure Service Water System

The low-pressure service water system supplies various heat exchangers and auxiliary equipment located in the generator plant and waste treatment building.

The system is supplied by two centrifugal pumps located in the crib house. Water is piped underground to the turbine building, entering in the turbine oil storage room. The main line then divides in the area above the service air compressors to provide various subsystems with cooling water. These subsystems are listed in Table 3.4-1.

Table 3.4-1. Subsystems Supplied by the Low-Pressure Service Water System

High-pressure service water system (supply only)
Circulating water pump bearings
Component cooling heat exchangers (two units)
Generator hydrogen coolers (four units)
Condenser vacuum pump
Turbine lube oil coolers
Air conditioning units (backup supply)
(a) Office building
(b) Control room
Heating boiler relief valve flash tank (backup supply)
Reactor feed pumps lube oil and CPLG water coolers (two units)
Waste gas system
(a) Waste gas compressor
(b) Waste gas compressor inner and after coolers
(c) Recombiner condenser
Contaminated liquids disposal system
(a) Concentrated waste tank
(b) Spent resin tank
(c) Evaporator condenser
(d) Drumming station area
Turbine condenser discharge water radiation monitor eductor

From the ER.

3.4.3 High-Pressure Service Water System

The high-pressure service water system supplies the fire protection system, the high-pressure core spray system backup, the alternate core spray system, circulation water outfall contamination monitor eductor (backup supply), and the crib-house screen wash system.

The high-pressure service water pump takes a positive suction at about 65 psig from the low-pressure service water system. It discharges into a header that divides into two main loops. One loop serves the turbine building, containment building, waste treatment building, and gas vault; the other loop supplies the outside fire protection system and the crib house.

During normal operation, system pressure is maintained between 100 and 140 psig. The pump is protected against a low suction pressure by a 35-psig suction pressure tip. Backup protection for the system is provided by one of two diesel-driven auxiliary service water pumps that will maintain system pressure between 60 and 150 psig.

A fire protection sprinkler system for the oil storage room and for the turbine oil reservoir is supplied by the high-pressure service water system.

3.4.4 Condenser Cooling Water System

Circulating water is drawn into the crib-house intake flume at 64,000 gpm by two pumps located in separate open suction bays and is discharged 200 feet downstream of the intake flume. This system is described more fully in Section 3.5 below.

The surface condenser is rated at 4.23×10^8 Btu/hr for a flow rate of 64,000 gpm at a 60°F inlet temperature. Normally the operating ΔT is 15°F. The seasonal temperature variation of the river is approximately 32°F to 80°F. The condenser transit time is 12 seconds.

3.4.5 Water Collection and Disposal

The main condenser cooling water is returned directly to the river. The remainder of the water wastes are disposed of as follows:

Low-level liquid wastes are collected and discharged on a batch basis through a radiation monitor to the main condenser circulating water system.

If necessary, a radwaste ion exchange unit is available to reduce the radioactivity level in low-conductivity liquid wastes. The liquid can be transferred to the main condenser hot well for reuse or discharged through a radiation monitor directly to the river after being diluted with main condenser circulating water.

Depleted ion exchange resins are sluiced into a spent resin tank in the waste treatment building. The resins may be stored for decay, or placed directly in shipping casks for offsite disposal at a licensed disposal site.

The system is designed to operate in a batch manner. The radioactive wastes are maintained as distinct batches throughout treatment between individual samplings and operations. The details of the liquid radwaste system are presented in Section 3.6.2. Liquid waste sources and quantities are presented in Table 3.4-2.

Table 3.4-2. Liquid Waste Sources

Source	Maximum, gal/day	Average, gal/day
Reactor building		
Floor drains and sump	1,000	300
Process drains	12,000	730
Turbine building		
Floor drains and sump	1,000	133
Process drains	3,000	300
Regenerant solution	4,500	400
Hot change room drains	150	-

From the ER.

3.5 HEAT DISSIPATION

3.5.1 Intake System

Cooling water for the main condenser of the plant is withdrawn from the Mississippi River through the intake structure shown in Fig. 3.5-1. Two pumps are located in separate open suction bays. Each pump discharges into a 42-inch pipe. The pipes join a common 60-inch pipe leading to the main condenser in the turbine building. At the condenser, the 60-inch pipe branches into two 42-inch pipes feeding the top section of the divided water boxes. The main condenser is a two-pass divided water box type. Circulating water enters the top section of the condenser tube side and is discharged from the bottom section tube side. Two 32,000-gpm circulating water pumps, located in separate suction bays in the crib house, supply water to the condenser. The intake water velocity at 64,000 gpm is 0.67 ft/sec. Bar grills and traveling screens are located in the crib house upstream of the circulating water pumps. The screen baskets are Number 10 W and M, galvanized square open mesh. Each screen is equipped with high-pressure water spray nozzles which wash debris from the baskets into a trough which discharges downstream of the intake flume. Further details are given in Section 11.5.3.

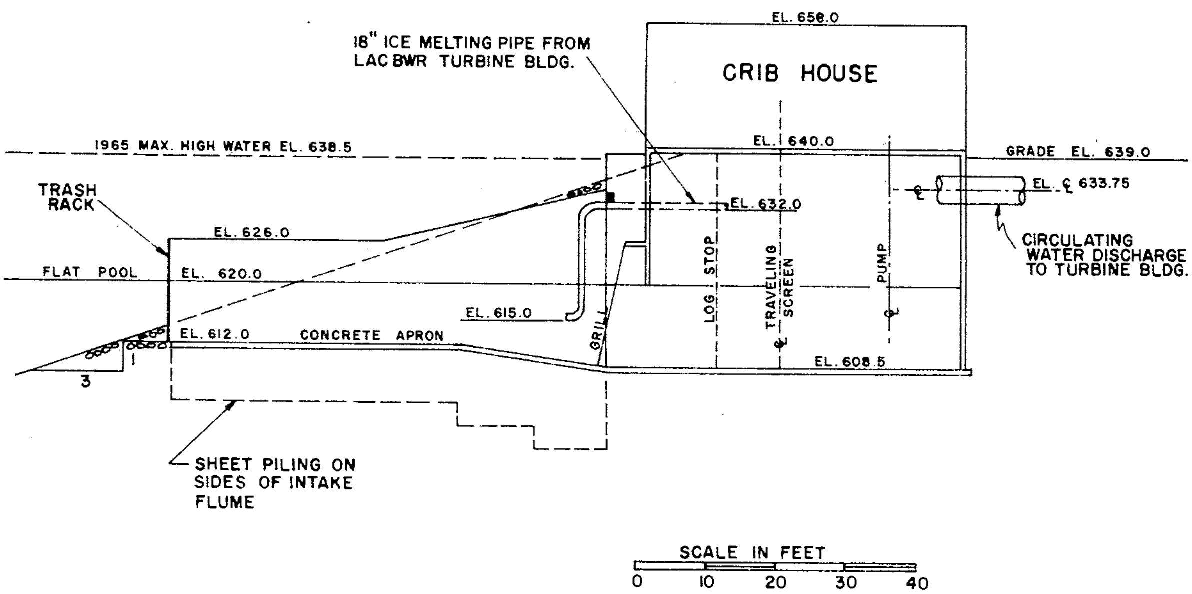

Fig. 3.5-1. Cross Section of the Intake Structure. From the ER.

3.5.2 Discharge System

The 42-inch condenser circulating water lines join in a common 60-inch line to the seal well, which is on the river bank, 200 feet downstream of the intake flume. This location ensures that discharge water will not be drawn into the intake flume and be recirculated through the condenser.

The discharge line from the LACBWR condenser joins the discharge from the Genoa 3 plant in the structure shown in Fig. 3.5-2. The Genoa 3 line is the 90-inch pipe and the LACBWR line is the 60-inch pipe. The two circulating water pumps of Genoa 3 are each rated at 95,000 gpm as contrasted with the 32,000-gpm rating of the LACBWR pumps. Hence, during operation, the combined discharge can vary from 32,000 gpm with one LACBWR pump on line to a maximum of 254,000 gpm with two LACBWR and two Genoa 3 pumps in operation.

The total transit time for the LACBWR cooling water from intake to discharge is 2.14 minutes. The main condenser circulating water system for the two plants is shown schematically in Fig. 3.5-3. The combined discharge enters Thief Slough (Fig. 2.1-1) downstream of the two intakes.

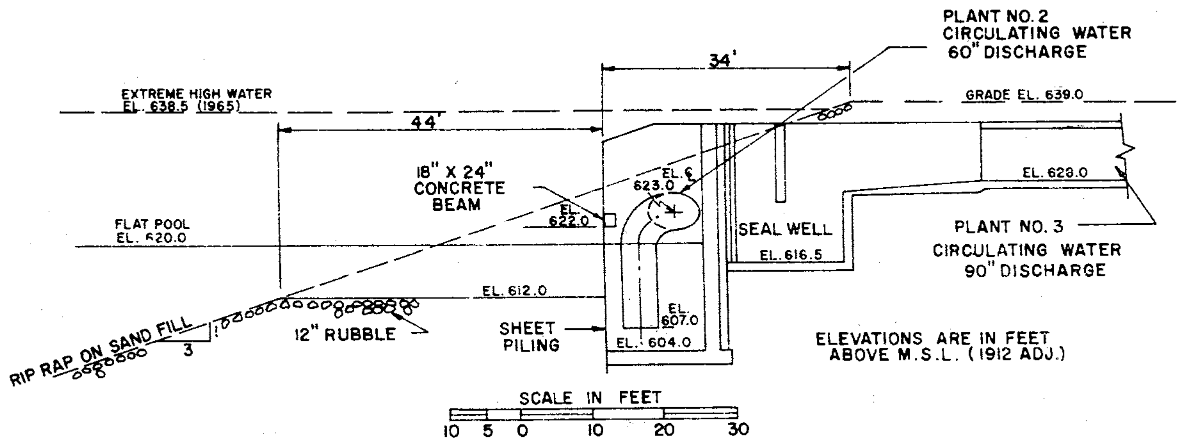

Fig. 3.5-2. Circulating Water System Discharge Structure. From the ER.

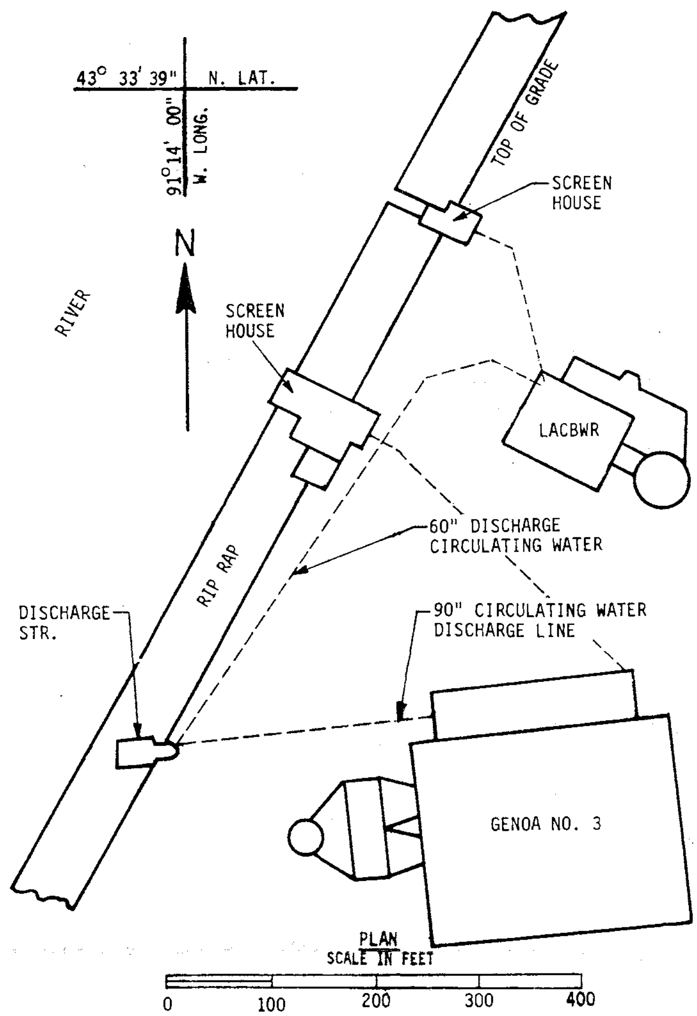

Fig. 3.5-3. Circulating Water Systems for LACBWR and Genoa 3.

A rock closing dam extending toward the discharge in a northeasterly direction from Island 126 constricts the river flow as it enters the slough. The resulting current velocity (5 to 10 ft/sec) and water turbulence in the area os the outfall ensure rapid thermal mixing and prevent significant stratifications.

3.6 RADIOACTIVE WASTE SYSTEMS

During operation of the LACBWR, radioactive material is produced by fission and by neutron activation of corrosion products in the reactor coolant system. From the radioactive material produced, small amounts of gaseous and liquid radioactive wastes enter the waste streams. These streams are processed and monitored within the plant to minimize the quantity of radioactive nuclides ultimately released to the environment.

The waste handling and treatment systems installed at the plant are discussed in the licensee's Safeguards Report for Operating Authorization and in his Environmental Report. In the Environmental Report, the licensee presents a summary of operating experience in terms of released radioactivity in liquid and gaseous effluents.

In the following paragraphs, the waste treatment systems are described and an analysis is given based on the staff's model of the licensee's radioactive waste systems. The staff's model has been developed from a review of the previous operating experience of the LACBWR as well as available data from other operating boiling water reactor plants, adjusted to apply over a 30-year operating life.

While the effluent releases projected by the staff in the Draft Environmental Statement were based solely on calculations using the GALE Code, the current effluent source terms are based only on actual operating data from LACBWR. The staff's liquid and gaseous source terms are based on: (1) data in the licensee's semi-annual effluent release reports for the years 1978 through 1979, (2) information provided by the licensee for LACBWR to meet the requirements of Section V.B of Appendix I to 10 CFR Part 50, and (3) information contained in NUREG-0016, "Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Boiling Water Reactors (BWR-GALE Code)," dated April 1976. The principal parameters used in the staff's source term calculations are given in Table 3.6-1.

Table 3.6-1

PRINCIPAL PARAMETERS USED IN CALCULATING RELEASES OF RADIOACTIVE MATERIALS IN LIQUID AND GASEOUS EFFLUENTS FROM LA CROSSE BOILING WATER REACTOR

Reactor Power Level (MWt)	165
Plant Capacity Factor	0.71[a]
Noble Gas Release Rate from Mechanical Vacuum Pump	5.7×10^3 μCi/sec
Annual Operating Time of Mechanical Vacuum Pump	24 hours
Ratio of Xe-133 to Xe-135 in Mechanical Vacuum Pump Offgas	6.6
Ratio of I-131 Concentration in Reactor Coolant During Mechanical Vacuum Pump Operation to I-131 Concentration in Reactor Coolant during Steady State Full Power Operation	3

[a]Based on nine years of operation at an average plant capacity factor of 0.5 and 21 years of operation at a plant capacity factor of 0.8.

In conformance with the requirements of Section V.B of Appendix I, Dairyland Power Cooperative (DPC) filed with the Commission on June 3, 1976,[2] and in subsequent submittals dated November 17, 1976; May 18, 1977; June 24, 1977; July 29, 1977; February 23, 1978; and July 12, 1978, the necessary information to permit an evaluation of the LaCrosse Boiling Water Reactor, with respect to the requirements of Sections II.A, II.B, and II.C of Appendix I. In these submittals, DPC chose to perform the detailed cost-benefit analysis required by Section II.D of Appendix I to 10 CFR Part 50.

3.6.1 Liquid Waste Systems

The liquid radioactive waste treatment system consists of process equipment and instrumentation necessary to collect, process, and monitor potentially radioactive liquid wastes discharged from the plant. Liquid wastes are handled on a batch basis to permit optimum control of releases. Prior to release of any liquid wastes, samples are analyzed to determine the type and amount of radioactivity in the batch. Based on the results of the analysis, these wastes are either released under controlled conditions to the Mississippi River or retained for processing. Radiation detectors in the waste discharge line activate a high radioactivity alarm for activity levels which exceed predetermined values. A simplified diagram of the processing of radioactive liquid wastes is shown in Figure 3.6-1.

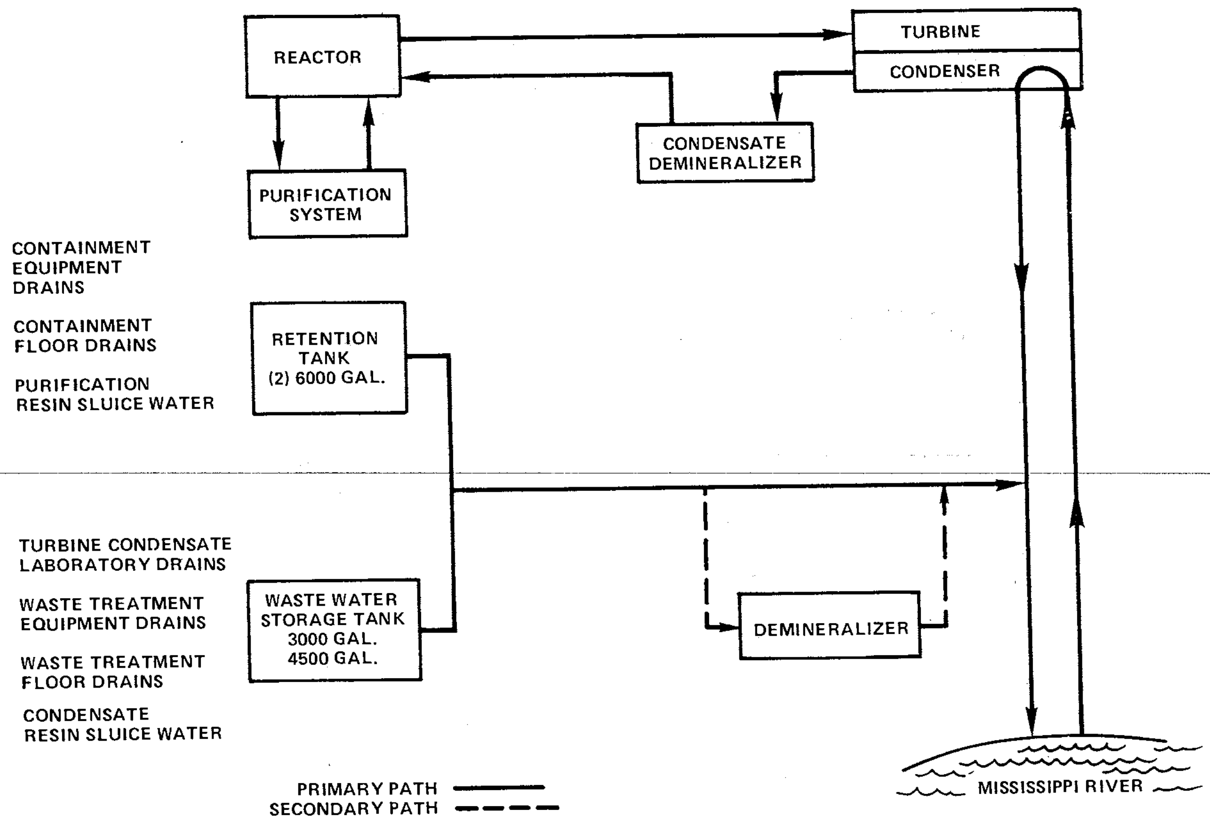

Fig. 3.6-1. Liquid Waste Treatment System.

The liquid radioactive waste management systems consist of the containment building collection subsystem and the turbine building collection subsystem.

3.6.1.1 Containment Building Collection Subsystem

The containment building collection subsystem collects the equipment drains, floor drains, and sluice water from primary purification system resins in two 6000-gallon retention tanks. The wastes are sampled and discharged directly to the Mississippi River or retained for processing through the radwaste demineralizer if sampling indicates processing is necessary. The processed waste is discharged directly to the Mississippi River after passing through radiation detectors in the discharge line.

3.6.1.2 Turbine Building Collection Subsystem

The turbine building collection subsystem collects condensate leakage, hot change room and laboratory drains, floor drains and process drains in the waste treatment building, and sluice water from condensate demineralizer system resins in either a 3000-gallon or a 4500-gallon waste water storage tank. The wastes are sampled and discharged directly to the Mississippi River or retained for processing through the radwaste demineralizer if sampling indicates processing is necessary. The processed waste is discharged directly to the Mississippi River after passing through radiation detectors in the discharge line.

3.6.1.3 Liquid Waste Summary

Based on the staff's evaluation of the releases of radioactive material in liquid effluents from LACBWR for the period 1978 through 1979, and the parameters listed in Table 3.6-1, the staff calculated the releases of mixed fission and activation products (except tritium) to be approximately 11 Ci/yr and approximately 67 Ci/yr for tritium.

In comparison, the licensee estimates releases of mixed fission and activation products (except tritium) to be 5.3 Ci/yr and 41 Ci/yr for tritium. The staff's higher estimated release values are the result of the staff's use of effluent release data for the period 1978 through 1979 and the assumption of a higher plant capacity factor for future operation of LACBWR. The licensee's estimated releases are based solely on the actual releases from LACBWR for the year 1976. The radionuclides expected to be released annually from the plant are given in Table 3.6-2.

Table 3.6-2

CALCULATED RELEASES OF RADIOACTIVE MATERIALS IN LIQUID EFFLUENTS FROM LA CROSSE BOILING WATER REACTOR

Nuclide	Ci/yr	Nuclide	Ci/yr
Corrosion & Activation Products		Fission Products (continued)	
Cr-51	8.3(-2)[a]	Tc-99m	5.2(-2)
Mn-54	2.6(-1)	Ru-103	9.7(-2)
Mn-56	7.5(-5)	Ru-106	2.6(-1)
Fe-59	3.5(-2)	Sb-122	3.6(-4)
Co-57	7.3(-2)	Sb-124	5.1(-3)
Co-58	2.0	Sb-125	1.3(-4)
Co-60	2.6	I-131	2.1(-1)
Ni-65	3.1(-4)	I-132	3.4(-3)
Zn-65	1.5(-1)	I-133	4.7(-2)
Cd-109	1.6(-1)	I-134	1.1(-3)
Np-239	1.2(-1)	I-135	1.3(-2)
Cm-241	1.6(-3)	Cs-134	3.0(-1)
Fission Products		Cs-136	1.2(-2)
		Cs-137	9.0(-1)
Rb-88	9.5(-3)	Cs-138	8.7(-3)
Sr-89	1.2	Ba-133	4.7(-4)
Sr-90	1.6(-2)	Ba-140	8.3(-2)
Sr-91	2.7(-3)	Ce-141	4.5(-2)
Sr-92	6.3(-3)	Ce-144	1.3
Y-91m	6.3(-3)	Nd-147	6.0(-3)
Y-91	4.1(-4)		
Y-92	9.5(-3)	All others	2.8(-5)
Zr-95	1.9(-1)	Total (except H-3)	11
Nb-95	3.6(-1)	H-3	67
Nb-97	3.8(-3)		
Mo-99	3.9(-3)		

[a]Exponential notation; 8.3(-2) = 8.3×10^{-2}.

3.6.2 Gaseous Waste System

The gaseous radioactive waste treatment and plant ventilation systems consist of process equipment and instrumentation necessary to collect, process, store, and monitor potentially radioactive gaseous wastes discharged from the plant. During power operation of the plant, radioactive material released to the atmosphere in gaseous effluents includes fission product and activation gases, halogens (mostly iodine), tritium contained in water vapor, and particulate material including fission products and activated corrosion products. The principal sources of gaseous waste are the effluents from the main condenser air ejector, the mechanical vacuum pump, the turbine gland seal exhaust, the containment building ventilation system, the waste treatment building ventilation system, and the turbine building ventilation system. A simplified diagram of the processing of radioactive gaseous waste and of ventilation paths is shown in Figure 3.6-2.

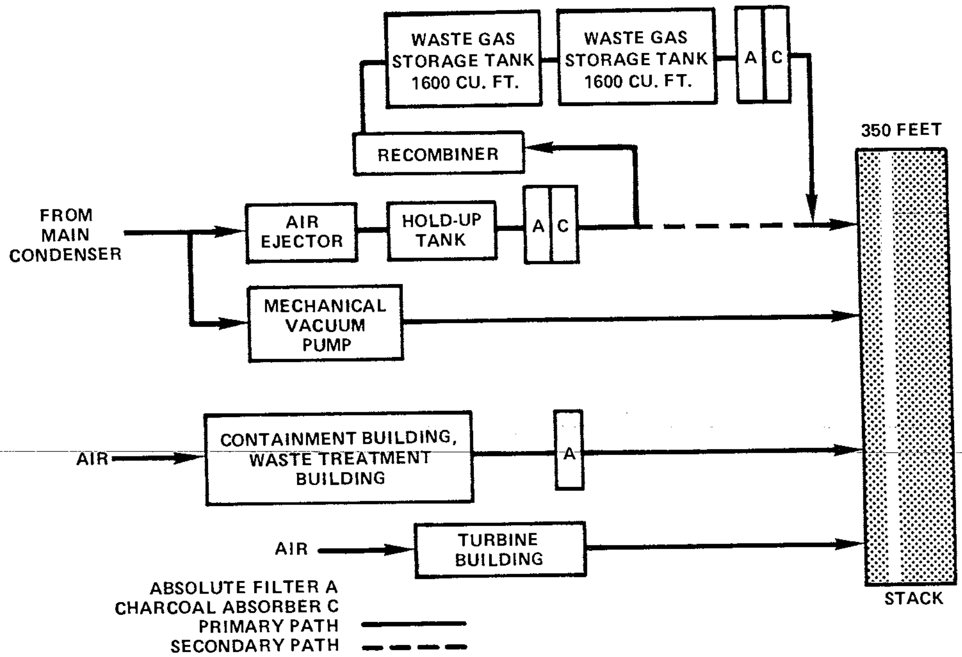

Fig. 3.6-2. Gaseous Waste and Ventilation Systems.

3.6.2.1 Main Condenser Off-Gas System

The main condenser off-gas system is designed to process the off-gas from the main condenser air ejectors. The gases are directed to a 150 ft^3 hold-up tank where they reside for approximately 10 minutes to reduce the activity of short-lived radionuclides. From the hold-up tank, the gases are dried and passed through a filter train consisting of an HEPA filter and a downstream charcoal adsorber. Following filtration, the gases are mixed with steam in an ejector and passed through a recombiner to recombine the hydrogen and oxygen in the waste gas. The steam carrier gas is condensed in the recombiner condenser and the non-condensible gases are vented to two 1600 ft^3 storage tanks which are connected in series. In early 1978, modifications to the off-gas system were completed to allow additional delay in the storage tanks to provide downstream HEPA/charcoal filtration prior to discharge to the environment. The outlet valve on the storage tanks is normally open so that the off-gas flows continuously through the tanks to a HEPA filter and downstream charcoal adsorber prior to discharge to the environment via the 350 ft plant stack.

3.6.2.2 Ventilation Systems

Radioactive materials are introduced into the reactor containment, waste treatment, and turbine building atmospheres because of leakage from equipment transporting or handling radioactive materials. There are provisions to pass ventilation air from the waste treatment and reactor containment buildings through HEPA filters prior to discharge to the facility stack, and HEPA filtration was assumed in the staff evaluation. The ventilation air from the turbine building is exhausted directly to the stack without treatment.

3.6.2.3 Turbine Gland Seal and Mechanical Vacuum Pump

The main turbine gland seal uses steam generated from the No. 2 feedwater heater condensate. The gland seal steam effluent is routed to the main condenser and any non-condensibles are processed in the main condenser off-gas system.

The mechanical vacuum pump, used during startup, exhausts air and trace quantities of radioactive gases from the main condenser to the stack without treatment.

3.6.2.4 Gaseous Waste Summary

Based on the staff's evaluation of the releases of radioactive material in gaseous effluents for the period 1978 through 1979 and the parameters listed in Table 3.6-1, the staff calculated the releases to be approximately 14,200 Ci/yr of noble gases, 0.031 Ci/yr of I-131, 0.0032 Ci/yr of particulates, and 10 Ci/yr of tritium.

In comparison, the licensee estimates releases of approximately 32,000 Ci/yr of noble gases, 0.048 Ci/yr of I-131, 0.023 Ci/yr of particulates, and 13 Ci/yr of tritium. The licensee's higher release estimates for noble gases, I-131, and particulates are based on measurements of actual releases during early 1977 and, thus, do not reflect subsequent modifications to the off-gas treatment system which provide for longer decay time in the gas storage tanks and downstream HEPA/charcoal filtration prior to discharge to the environment. The licensee's estimated tritium release is similar to the staff's estimate.

The radionuclides expected to be released annually from the plant are given in Table 3.6-3.

The DPC Radioactive Effluent Report for 1979 shows that during normal plant operation early in the current fuel cycle (late summer 1979) with the off gas system fully operative, the measured radioactivity release rate at the stack (essentially radioactive noble gases) averaged 325 curies per month. Under similar conditions, but later in the fuel cycle (March 1980), the measured release rate was 282 Ci/month. During a large part of the current fuel cycle, the flow monitor down stream of the hydrogen recombiner was inoperative, and during this period, the flow used to determine the radioactive release rate was based on a flow measurement prior to the hydrogen recombiner. This resulted in reported release rates that are conservatively high, i.e., higher than the actual stack radiation release rate, by a factor of about two.

Table 3.6-3

CALCULATED RELEASES OF RADIOACTIVE MATERIALS IN GASEOUS EFFLUENTS FROM LA CROSSE BOILING WATER REACTOR

	RELEASE Ci/yr		
Nuclides	Continuous Stack Releases	Intermittent Stack Releases	Total
Kr-85m	470	a	470
Kr-85	39	a	39
Kr-87	380	a	380
Kr-88	1000	a	1000
Kr-89	40	a	40
Xe-131m	15	a	15
Xe-133m	140	a	140
Xe-133	1420	680	2100
Xe-135m	850	a	850
Xe-135	5590	110	5700
Xe-137	160	a	160
Xe-138	3300	a	3300
I-131	2.7(-2)[b]	3.6(-3)	3.1(-2)
I-133	1.5(-2)	a	1.5(-2)
I-135	7.4(-3)	a	7.4(-3)
Sr-89	1.3(-3)	c	1.3(-3)
Sr-90	1.5(-4)	c	1.5(-4)
Cs-134	3.1(-5)	c	3.1(-5)
Cs-137	1.4(-4)	c	1.4(-4)
Ba-140	1.6(-3)	c	1.6(-3)
H-3	-	-	10
Ar-41	-	-	1
C-14	9.5	-	9.5

a = less than 1.0 Ci/yr for noble gases and carbon-14, less than 10^{-4} Ci/yr for iodine.
b = exponential notation; 2.7(-2) = 2.7×10^{-2}.
c = less than 1 percent of total for this nuclide.

3.6.3 Conformance with Federal Regulations

Based on the staff's evaluation of the radioactivity in liquid effluents from the LACBWR, the staff calculated the annual dose or dose commitment to the total body or to any organ of an individual in an unrestricted area to be less than 3 mrem and 10 mrem, respectively, in accordance with Section II.A of Appendix I to 10 CFR Part 50.

Based on the staff's evaluation of the radioactivity in gaseous effluents from the LACBWR, the staff calculated the annual gamma and beta air doses at or beyond the site boundary to be less than 10 mrad and 20 mrad, respectively in accordance with Section II.B of Appendix I to 10 CFR Part 50. Based on the staff's evaluation of the releases of radioiodine and particulates in gaseous effluents from LACBWR, the staff calculated the annual dose or dose commitment to any organ of the maximum exposed individual to be less than 15 mrem, in accordance with Section II.C of Appendix I to 10 CFR Part 50.

Radiological impact to man is further discussed in Section 5.5.

Section II.D of Appendix I to 10 CFR Part 50 requires that liquid and gaseous radwaste systems for light-water-cooled nuclear reactors include all items of reasonably demonstrated technology that, when added to the system sequentially and in order of diminishing cost-benefit return, can for a favorable cost-benefit ratio, effect reductions in dose to the population reasonably expected to be within 50 miles of the reactor. The staff's cost-benefit analysis was performed using: (1) the population doses given in Table 5.X; (2) the analysis procedures outlined in Regulatory Guide 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Reactors," March 1976; (3) the cost parameters given in Table 3.6-4; (4) the capital costs as provided in Regulatory Guide 1.110; and (5) values of $1,000 per total body man-rem and $1000 per man-thyroid-rem.

Table 3.6-4

PRINCIPAL PARAMETERS USED IN THE COST-BENEFIT ANALYSIS FOR LA CROSSE BOILING WATER REACTOR

Labor cost correction factor, FPC Region IV[a]	1.4
Indirect cost factor[a]	1.75
Cost of money[b]	12.3%
Capital recovery factor[a]	0.090

[a]From Regulatory Guide 1.110, Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors (March 1976).

[b]Value furnished by Dairyland Power Cooperative.

For the liquid radwaste system, the calculated total body and thyroid doses from the liquid releases to the projected population within a 50-mile radius of the station, when multiplied by $1,000 per total body man-rem and $1,000 per man-thyroid-rem, resulted in cost-assessment values of $1,700 for the total body man-rem dose and $30 for the man-thyroid-rem dose. The least expensive augment was the possible addition of a 20 gpm cartridge filter to the liquid waste system. The calculated cost of $14,300 for this augment exceeded the cost-assessment values for the liquid radwaste system. The staff concludes, therefore, that there are no cost-effective augments to reduce the cumulative population dose at a favorable cost-benefit ratio, and that the modified liquid radwaste system meets the requirements of Section II.D of Appendix I to 10 CFR Part 50.

For the gaseous radwaste system, the calculated total body and thyroid doses from gaseous releases to the projected population within a 50-mile radius of the station, when multiplied by $1,000 per total body man-rem and $1,000 per man-thyroid-rem, resulted in cost-assessment values of $720 and $1150, respectively. The most effective augment was the possible addition of a 3-ton charcoal adsorber to the off-gas treatment system. The calculated cost of $16,100 for this augment exceeded the cost-assessment values for the gaseous radwaste system. The staff concludes, therefore, that there are no cost-effective augments to reduce the cumulative population dose at a favorable cost-benefit ratio, and that the modified gaseous radwaste system meets the requirements of Section II.D of Appendix I to 10 CFR Part 50.

The staff concludes that the liquid and gaseous radwaste treatment systems are capable of reducing releases of radioactive materials in liquid and gaseous effluents to "as low as is reasonably achievable levels" in conformance with 10 CFR Part 50.34a and the requirements of Appendix I to 10 CFR Part 50. The staff therefore concludes that the systems are acceptable.

3.6.4 Solid Waste System

The solid waste system is designed to process two general types of solid wastes: "wet" solid wastes that require packaging and, in some cases, solidification prior to shipment and "dry" solid wastes that require packaging prior to shipment to a licensed burial facility. Wet solid wastes consist mainly of spent demineralizer resins spent filter cartridges. The principal sources of spent resins are the liquid radwaste ion-exchanger and the demineralizers in the primary purification system and condensate cleanup system. Spent resins are collected in the spent resin storage tank. Dry solid wastes consist of ventilation air filters and contaminated clothing, paper, rags, and miscellaneous items such as component parts.

When spent resin is packaged, the storage tank is pressurized and the dewatered resin is discharged to a 55-gallon drum or shielded shipping container, as necessary, for ultimate offsite shipment to a licensed burial facility. Evaporator bottoms are mixed with cement and absorbent in a 55-gallon drum prior to offsite shipment to a licensed burial facility. Dry wastes are packaged in 55-gallon drums for offsite disposal. All wastes are packaged and shipped to a licensed burial facility in accordance with NRC and Department of Transportation (DOT) Regulations.

For the calendar years 1978 and 1979, the licensee shipped to a licensed site for burial approximately 460 ft^3 of resin/sludge waste containing 186 Ci of activity and 1060 ft^3 of dry waste containing less than 1 Ci of activity. The staff estimates that these volumes and activities of solid wastes reasonably characterize expected volumes and activities from future operation of the plant.

3.7 CHEMICAL AND SANITARY DISCHARGE TO THE RIVER

The only direct discharge to the river comes primarily from the plant cooling water system. Table 3.7-1 shows the water quality parameters of the untreated intake cooling water and the discharged cooling water after it has passed through the condenser. No chlorine is used in the LACBWR cooling water system and therefore none is discharged to the river.*

Table 3.7-1. Intake and Discharge Water Quality (mg/L except turbidity)

Parameter	Intake Untreated for Cooling	Discharge
Alkalinity	142	133
BOD	2	3
COD	7	14
Total solids	225	280
Total dissolved solids	220	250
Total suspended solids	34	30
Total volatile solids	100	80
Ammonia (as N)	0.10	0.10
Kjeldahl nitrogen	1.0	1.10
Nitrate (as N)	1.24	1.1
Phosphorous (as P)	0.20	0.21
Turbidity (Jackson units)	7	7
Organic nitrogen	0.9	1.0
Sulfate	14	12
Sulfite	5.0	5.0
Chloride	10	7
Chromium	0.05	0.05
Potassium, total	2.30	2.90
Sodium, total	7	13
Zinc, total	0.10	0.05
Phenols	0.001	0.001
Surfactants	0.05	0.05

3.7.1 Chemical Discharges

About 100,000 gallons per year of wastewater from demineralizer regeneration are discharged to the Genoa 1 ashpit. The discharge occurs about once each week during operations in batches of about 2000 gallons. The average composition of the waste discharge is shown in Table 3.7-2. The pH of water standing in the pit will be much closer to neutral than the extreme values of the discharge.

*However, discharges from the Genoa 3 coal-fired plant are chlorinated and mixed with the LACBWR discharge just before release. As a result, LACBWR cooling water is briefly exposed to chlorine and biota may be damaged. Chlorination at Genoa 3 is done during the summer only on a maximum schedule of two half-hour periods per day. During 1979, chlorination occurred on 61 days with a maximum level of total residual chlorine at the discharge of 0.2 mg/L and monthly averages ranging from 0.01 to 0.13 mg/L.

Table 3.7-2. Description of Demineralizers Regeneration Discharge

Parameters	Maximum Concentration (mg/L, except turbidity and pH)
Alkalinity	133
C.O.D.	37
Total solids	4335
Total dissolved solids	4480
Total suspended solids	< 5
Total volatile solids	3670
Ammonia (as N)	0.25
Kjeldahl nitrogen	0.40
Nitrate (as N)	< 0.05
Phosphorus, total (as P)	< 0.1
Turbidity	1[a]
Acidity (as $CaCo_3$)	330
Total organic carbon	8.0
Total hardness	559
Organic nitrogen	0.2
Sulfate	1250
Chloride	7
Calcium, total	150
Chromium, total	< 0.05
Magnesium, total	46
Potassium, total	1.9
Sodium, total	12
Zinc, total	0.10
Phenols	< 0.001
Surfactants	< 0.05
pH	0.6 - 12

[a]Jackson units.

Chromium salts in the forms of $MgCrO_4$, $K_2Cr_2O_7$, and Na_2CrO_4 are used as rust inhibitors in the forced circulation pump system, the component cooling system, and the shield cooling system. Slow leakage may occur from the latter two systems and the forced circulation system may be drained to the Genoa 1 ashpit for maintenance. Chromium concentrations in any discharge are limited to a maximum of 0.005 mg/L. Total chromium salt losses and discharges are estimated to be about 28 lb/yr.

The chemicals used for scale prevention and pH control in the heating boiler are hydrazine and morpholine. The boiler is blown down once each week with an associated discharge volume of approximately 50 gallons. The average concentration of the two chemicals, hydrazine and morpholine, is 0.177 ppm for the hydrazine and sufficient morpholine to maintain a pH of 9.54.

During the calendar year 1979, 56 liters of morpholine and 3.75 liters of hydrazine were used in the heating boiler.

3.7.2 Sanitary Waste Discharge

No sanitary wastes are discharged to the river. All the waste from toilets is discharged to underground septic tanks located on the plant property. All water from the emergency showers and onsite laundry facilities is directed to the liquid radwaste system. Plant shower discharges are drained into the septic system.

3.8 OTHER WASTES

Roughly one cubic foot of combustibles is burned each day in an onsite incinerator. The noncombustibles are disposed of in a licensed offsite landfill area.

4. ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND PLANT CONSTRUCTION

4.1 IMPACTS ON LAND USE

The LACBWR stands on land formed by filling about 27 acres of lowland with material dredged from the Mississippi River off the construction site to a final level of 639 feet above mean sea level. Site preparation for LACBWR commenced in 1961 and the filling operations were completed in December 1965. All construction and site restoration work is now completed.

Site preparation for LACBWR and the adjacent Genoa 3 fossil-fueled plant involved the loss of the lowland forest that previously existed, and removed about 1500 feet of river bank from public use. The applicant provided a river access site, with a boat-launching facility and public parking lot, to the south of the power plant sites.

Since the 69-kV transmission line is completely on site, any impacts associated with its construction are indistinguishable from those associated with general site preparation and construction.

4.2 IMPACTS ON WATER USE

As mentioned above, approximately 27 acres of river and adjacent marshland were filled with material dredged from the main channel. Since dredging and deposition of spoil on river banks had been routine procedure in the maintenance of the navigation channel at the time of construction, no unusual water-use impact was created.

Prior to the construction of LACBWR, a small rock-fill dam closed the upper part of Thief Slough. This dam (with others) was constructed before the present system of navigation locks and dams on the Mississippi for the purpose of confining river water to the main navigational channel. The partial removal of the dam created a strong turbulent flow near the slough entrance replacing the previous slack pond character of the slough. The present flow character is probably closer to original stream behavior than when the dam was in place, and thus has no adverse impact.

4.3 EFFECTS ON ECOLOGICAL SYSTEMS

4.3.1 Terrestrial Impacts

The area modified for site development and preparation was deciduous forest containing some small ponds. This habitat is fairly common along the river in this area. The site in particular did not possess any exceptional attributes, especially insofar as Genoa 1 and Lock and Dam No. 8 had already introduced an intensive level of human activity and use. Although no surveys were made before or after plant construction, because of the intensive human activity and the abundance of similar habitat in the area, it is unlikely that site preparation and construction activities caused any adverse effects to terrestrial ecosystems beyond the immediate vicinity of the site.

4.3.2 Aquatic Impacts

The filling of the forest ponds and the dredge and fill operations resulted in loss of habitat and the associated biota. The amount of habitat is small relative to the total amount extant and there is no evidence it possessed exceptional attributes. The disturbance due to construction in the unfilled habitat should not have resulted in any long-term modification of the biota, not only because benthic populations quickly recover from such stresses, but also since the aquatic community was and is frequently stressed by a variety of insults ranging from natural floods to churning from barges.

4.4 IMPACTS ON PEOPLE

The construction of LACBWR displaced two permanent residences, each having one family, for a total of seven people. Certain adverse social and economic impacts are inevitable consequences

of any large construction project. These include increased highway traffic and need for road repairs, the need for housing construction workers, and burdens on local community services such as schools and law enforcement. During the peak period of construction in early 1966, about 400 people were employed. None of these impacts were exceptionally severe during the construction of LACBWR. Provision of the boat-launching facility has resulted in increased access to pool 9 and associated recreational activities.

5. ENVIRONMENTAL EFFECTS OF OPERATION OF THE PLANT AND TRANSMISSION FACILITIES

5.1 IMPACTS ON LAND USE

5.1.1 Plant Operation

Operation of the plant has necessitated the establishment of an exclusion area with a radius of 1109 feet, but has caused no changes in land use. The exclusion area consists mainly of the applicant's property, the waters of the Mississippi River, and portions of the Federal Wildlife and Fish Refuge defined by this radius. The balance of the exclusion area includes short sections of highway and railroad rights-of-way and parts of the steep bluffs to the east. Within the exclusion area the applicant has authority to determine all activities, including the removal of personnel and property.

5.1.2 Transmission Lines

The Genoa 3 fossil-fuel plant and all necessary transmission lines were completed before LACBWR went into commercial operation, and no additional offsite lines were required for LACBWR. The LACBWR output is connected by an onsite 69-kV line to the main switchyard, also on the site, which feeds the offsite lines. This onsite line, about 1000 feet long, is supported by a single tower, and has no impact on land use outside the applicant's property.

5.1.3 Floodplain Management Under Executive Order 11988*

Prior to construction, the site location was within the Mississippi River floodplain as defined by the 100-year flood. According to the licensee (ER, pp. 2-1 and 2-62 through 2-65, and letter dated February 22, 1980) the site was developed by raising the elevation of the floodplain in the area to 639 feet MSL. This elevation was selected on the basis of the calculated 100-year flood, which would reach an elevation of 635.2 feet MSL with a flow of 220,000 cfs. The highest floods on record did not reach 639 feet, although flows in excess of 220,000 cfs have been recorded as shown in Table 5.1-1.

On the site, besides the LACBWR facility complex, there are oil- and coal-fired units as well. The first fill for the site was placed in the middle 1940s to accommodate the oil-fired unit (Genoa 1). The site received additional fill in 1961 for LACBWR (Genoa 2) and again in 1969 for the coal-fired unit (Genoa 3). All the units have been operating for a number of years prior to issuance of E.O. 11988.

Because the site is near (about 3300 ft downstream) U.S. Lock and Dam No. 8, and no large stream enters the river between the site and dam, the area potentially impacted is small. There are no significant structures along the river in this area. Thus, the incremental impacts of floods caused by the presence of the site would be expected to be small. The only structures now in the river are the intake and discharge structures (the latter being common to LACBWR and Genoa 3).

Because the units are fully built and operational, the site is devoted to both nuclear and fossil plants, and no evidence has been claimed of adverse flood impacts because of the presence of the site (further, no additional fill is planned), the licensing action under consideration--the conversion of a provisional operating license to a full-term operating license--will neither affect any existing floodplain impacts nor present opportunities to mitigate such impacts. Thus, there are no practicable or reasonable measures available to enhance floodplain values in this case.

*E.O. 11988 provides for avoidance of direct or indirect support of floodplain development wherever practicable alternatives exist and for continuing interest in minimizing, restoring, and preserving floodplain values.

Table 5.1-1. Flow Data from the Genoa Station

Year	Flow (cfs)	Elevation (ft MSL)
1952	200,000	634.49
1965	274,000	638.4
1969	230,000	635.24

5.2 IMPACTS ON WATER USE

5.2.1 Surface Water

Mississippi River water is used for once-through cooling of the main condensers, as well as for general use in the plant low-pressure water system. At 80% capacity factor, approximately 2×10^{10} gallons per year are used for condenser cooling at 64,000 gallons per minute. The Genoa 3 fossil-fuel plant, with a separate intake but common discharge, uses water at a maximum rate of 190,000 gpm.

About 1.1×10^9 gallons per year of river water are used in the plant low-pressure system. This water is used for generator and component cooling, back-up air conditioning, contaminated waste disposal, and supply to the high-pressure system. The high-pressure system provides for fire protection, core spray, and traveling screen wash. Contaminated waters are purified and if shown to be acceptable by suitable monitoring are returned to the condenser discharge. Water quality parameters of intake and discharge waters are shown in Table 3.7-1.

Waste waters from demineralizer regeneration are discharged to the Genoa 1 ashpit. This pit has an area of about 1200 ft^2 and is about 20 feet deep. Fly ash deposits at the pit bottom are essentially impervious so that water does not enter the alluvium but drains by permeation through the dike into the river.

Since Genoa 1 is now burning oil, the pit no longer receives coal ash and the liquids are almost entirely demineralization recharge wastewaters. Although discharges from either anionic or cationic exchangers may reach extreme pH values, the mixture found in the ashpit should be much closer to neutral. An estimate of the water quality in the Genoa 1 pit may be obtained from the Genoa 3 ashpit water analysis given in Table 5.2-1, since this ashpit receives similar demineralizer discharges from Genoa 3 operations.

Since the average discharge rate over the year for the demineralizers is about 0.2 gpm, the effect would be negligible even if all the discharge reached the river.

5.2.2 Groundwater

During a year's operation about 6×10^7 gallons are taken from two relatively shallow (92 and 129 feet) onsite wells at a rate of 120 gpm at 62% capacity. These wells do not penetrate the main rock aquifers and apparently draw some water from the river through the alluvium. The applicant states (ER, Sec. 2.5.2) that "It is virtually impossible that a cone of depression ... could extend underneath the reactor site and reverse the water table gradient and it is extremely unlikely that pumping from the nearby wells could produce such an effect." Although no specific well capacity or drawdown data are supplied by the applicant, the Franconia sandstone and overlying sand and gravel aquifers are recognized as having a tremendous capacity and there has been no operational evidence of water table lowering. Since groundwater flow is toward the river, it is unlikely that plant effluent affects nearby wells (ER, Suppl. July 10, 1973).

Water from the sanitary system after septic tank treatment is emptied to a dry well, where it enters the alluvial water system. The quantity is too small to have any expected adverse effect on any present or future use of groundwater.

As noted above, the staff does not expect any leaching of the discharge to the Genoa 1 ashpit to reach the groundwater, due to the impermeability of the fly ash and to the fact that the groundwater table gradient is toward the river.

Table 5.2-1. Water Quality of Genoa 3 Ashpit Discharge

pH	6.7-8.3
Suspended solids	2-70 ppm
Dissolved solids	230-500 ppm
Cu	∿30 μg/L
Ni	<30 μg/L
Fe	8-700 μg/L
Zn	10 μg/L
Cr	25 μg/L
Cd	<10 μg/L
SO_4	100-200 mg/L

Source: Letter from Dennis Brendel, Dairyland Power Cooperative, to Fred Vaslow, Argonne National Laboratory, June 18, 1974.

5.3 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

5.3.1 Information from Applicant

The applicant has not presented a formal analysis of the thermal discharge of the LACBWR based on modeling techniques. However, since the plant has been in operation, temperature measurements in the receiving channel water and also in the bottom sediments have been made. The applicant also points out properties of the hydraulic system which are significant for giving a qualitative evaluation of the thermal and chemical dispersion in the channel. Evaluation is complicated by the mixture of LACBWR with Genoa 3 effluent. On the basis of the relative sizes and thermal efficiencies of the two plants, at full power for each, LACBWR contributes about 20% of the total thermal load.

Normally LACBWR discharges 64,000 gpm of cooling water with a rated ΔT of 13°F and Genoa 3 discharges 190,000 gpm with a ΔT of 16.5°F, when each has two cooling pumps operating. In cold weather only one pump is used, leading to ΔT values about twice the above. When heated water is used for ice control in the intake, somewhat higher temperatures may also occur. What are apparently transient readings have gone as high as 56°F for ΔT for the Genoa 3 plant and 42°F for LACBWR. These high readings represent heat outputs above either the maximum capacity of the condenser for heat transfer or the maximum reactor heat output and may result from recirculation for icing control or may be erroneous.

The configuration of the discharge with respect to the entrance to Thief Slough is critical in understanding the dispersion properties of the system. The arrangement is shown in Fig. 5.2-1. The discharge is placed about 100 feet upstream from the opening to the slough formed by the partial removal of an old rock-fill dam between the shore and Island 126. That portion of the river's flow entering the slough passes through a 90-foot gap and several small breaks in the dam, as well as over the top during high water. From the entrance, the slough widens gradually and irregularly to about 400 feet and rejoins the main channel about one mile downstream. As a result of the narrow opening to a much wider channel, high flow rates and heavy turbulence occur in the neighborhood of the opening. A strong onshore component of flow, as evidenced by erosion around barge mooring cells, tends to quickly disperse the discharge.

As part of an ecological survey by R.G. Ranthum[1] in 1969 and 1970, a series of temperature measurements were made of discharge and river water. The measurements included use of fixed recording devices at several locations, as well as boat traverses from the discharge point to 2.5 miles downstream. Vertical profiles were also obtained in the traverses. The area was divided into four general zones or areas as shown in Fig. 5.3-1. Zone A, roughly the area between the discharge and the gap in the rock dam, could be characterized as a mixing zone and only in this area did large temperature gradients exist. Also in this area, particularly at the upper end, large point temperature fluctuations occurred as a consequence of the turbulent eddies. Zone A was further subdivided into smaller, approximately 100-foot long, zones as shown in Fig. 5.2-1. Ranges of maximum temperature deviations (from ambient river) are shown in

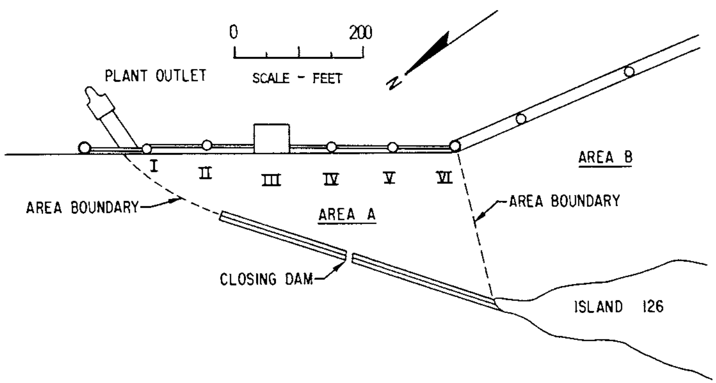

Fig. 5.2-1.

Map of Mixing Zone. (Modified from Environmental Report Comments and Responses.)

Table 5.3-1. Zone B constitutes the Thief Slough area; Zone C, the remixing area with the main channel; and Zone D, the areas unperturbed by the discharge.

In Zone A, highest temperatures occurred in an erratic horizontal band which shifted in position but was usually closer to the east side. By the end of Zone A this band had widened to cover the full width of the slough. Vertically, the high turbulence prevented formation of any definite thermal stratification. However, crude estimates could be made of the maximum depth to which the hot effluent was mixed. At the outfall, the depth was from 10 to 15 feet; at 100 feet downstream, 20 to 30 feet; and at about 200 feet, reached bottom.

In Zone B, the temperatures were generally uniform at one to two degrees above ambient, depending on the season. In Zone C, the temperatures were progressively lower than in Zone B, with some variations indicating a degree of channeling and stratification.

Generally both plants were operating during the measurement periods; however, no differences could be noted when Genoa 3 was operating without LACBWR. Total river flows during the measurement periods ranged from 8500 to 37,800 cfs. Specific time, river stages, flow velocities, and the fraction of flow in Thief Slough were not given.

As part of another ecological survey made by T.O. Claflin[2] of the University of Wisconsin at La Crosse, sediment temperatures at a number of positions along the bottom were measured. The positions of these points are shown in Fig. 5.3-2 and corresponding temperatures are shown in Table 5.3-2 for June and November of 1972. The June figures are consistent with the water temperature measurements indicating complete mixing by Zone B. However, the uniform bottom temperatures in November may indicate that warm water from the plume does not reach the bottom and that complete mixing does not occur.

Although the high flow velocity at the slough entrance may pick up silt and later deposit it on the wider part of the slough, the applicant states that investigation has revealed no flow blockage (ER, Suppl. July 10, 1973).

5.3.2 Staff Analysis of Thermal Discharge

While the system is highly complex, a model can be assumed appropriate which should give conservative estimates of the properties of the LACBWR thermal discharge. The assumptions necessary for the model are the fraction of total river flow in Thief Slough, the form of mixing where the discharge enters the water, and the form of dispersion beyond the discharge point.

The amount of water going through the slough is estimated from the relative widths of the main channel and the slough at the entrance and exit, assuming equal average channel depths of 20 feet. At the slough entrance the widths are 90 and 900 feet and at the exit 700 and 660 feet for slough and main channel respectively. A crude proportion gives 30% as the slough fraction and the value taken is 25%. Ranthum[1] estimates the flow velocity in the slough entrance as 5 to 10 fps and if 25,000 cfs is taken for average flow volume the comparable velocity calculated from the above assumption is 3.5 fps, so the assumptions are conservative. The form of mixing both at the discharge and in the mixing zone (Zone A) is also based in general on Ranthum's measurements. The plume at the slough entrance is taken to be plug flow (i.e., undiluted and uniform temperature) 10 feet deep and having the width necessary to contain the discharge flow at ambient stream velocity. Water from the discharge is assumed to displace normal river water so the total slough flow is unchanged. The assumptions used are summarized in Table 5.3-3.

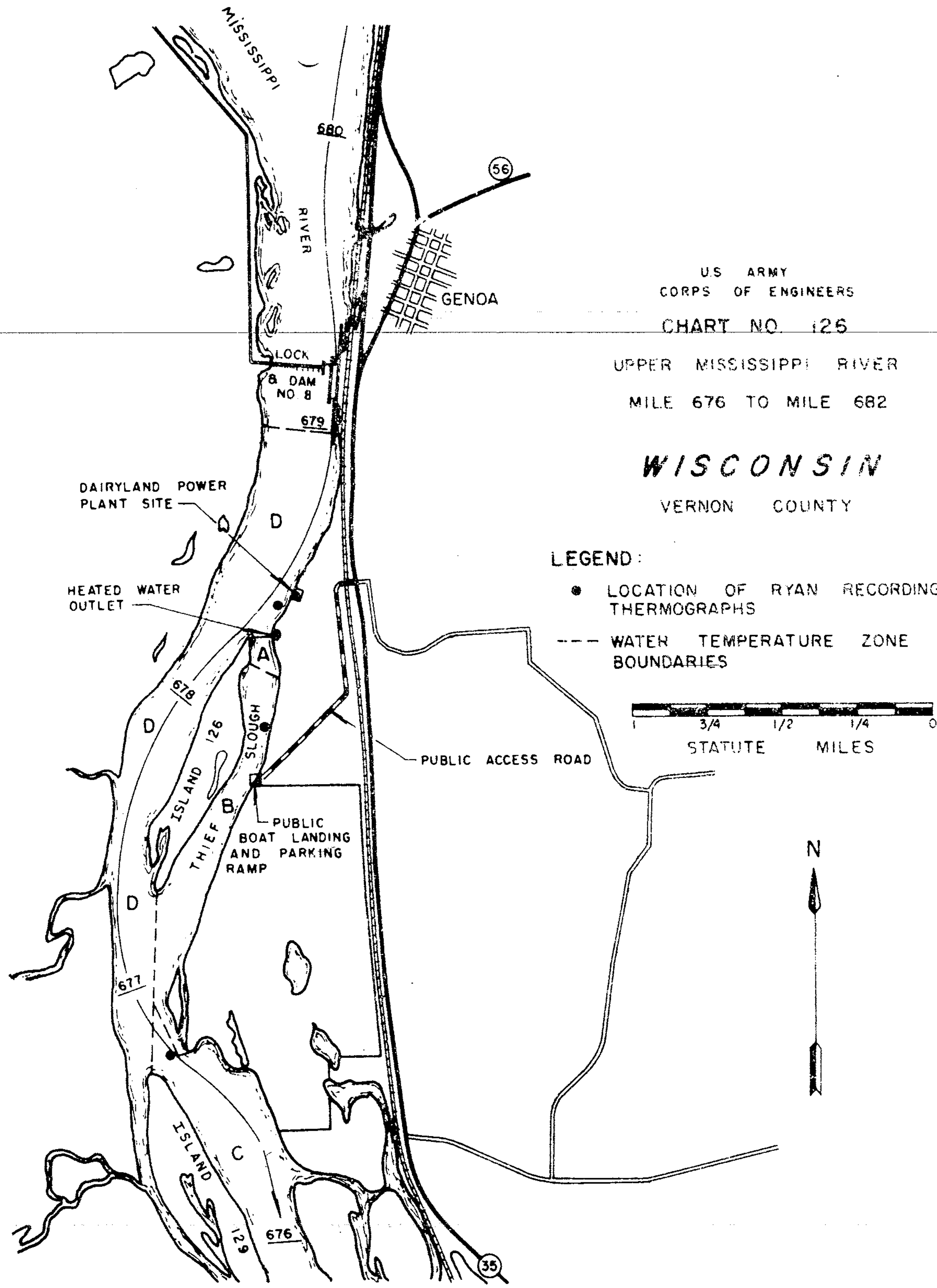

Fig. 5.3-1. Water Temperature Zones. (From the ER.)

Table 5.3-1. Maximum Temperature Differences from River Ambient (°F)

Area[a]	Summer	Winter
I	8-12	23-35
II	5-6	15-22
III	4-6	5-12
IV	2-6	5-7
V	2-5	4-6
VI	2-3	3-5

From R.G. Ranthum, Wis. Dept. of Natural Resources, Management Report #48.

[a]As defined in Fig. 5.2-1.

Table 5.3-2. Bottom Sediment Temperatures (°F)

Transect[a]	Month, 1972	Location[a] 1	2	3	4	5	6	7	8	9	10
A	June	60.2	60.2	60.1	60.1	60.1	60.1	60.1	60.2	60.2	60.2
	November	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5
B	June	65.3	64.6	64.2	64.2	64.2	64.1	64.1	64.0	63.9	63.9
	November	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5
C	June	64.0	-	-	64.4	64.4	64.4	64.4	-	64.4	64.4
	November	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5
D	June	52.6	64.8	64.6	64.4	64.6	64.8	64.6	64.6	64.6	64.6
	November	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5

From T.O. Claflin, as summarized in the applicant's Environmental Report (Sec. 5.1) and June 15, 1973, Supplement.

[a]As shown in Fig. 5.3-2.

Table 5.3-3. Dimensions and Velocities in Mixing Zone A Assumed for Thermal Dispersion Model Calculations

Length of Zone A	550 ft	Minimum flow	1425 cfs
Entrance width	90 ft	Average flow	6800 cfs
Exit width	225 ft	Velocity at entrance	
Depth	20 ft	Minimum flow	0.8 cfs
		Average flow	3.5 cfs

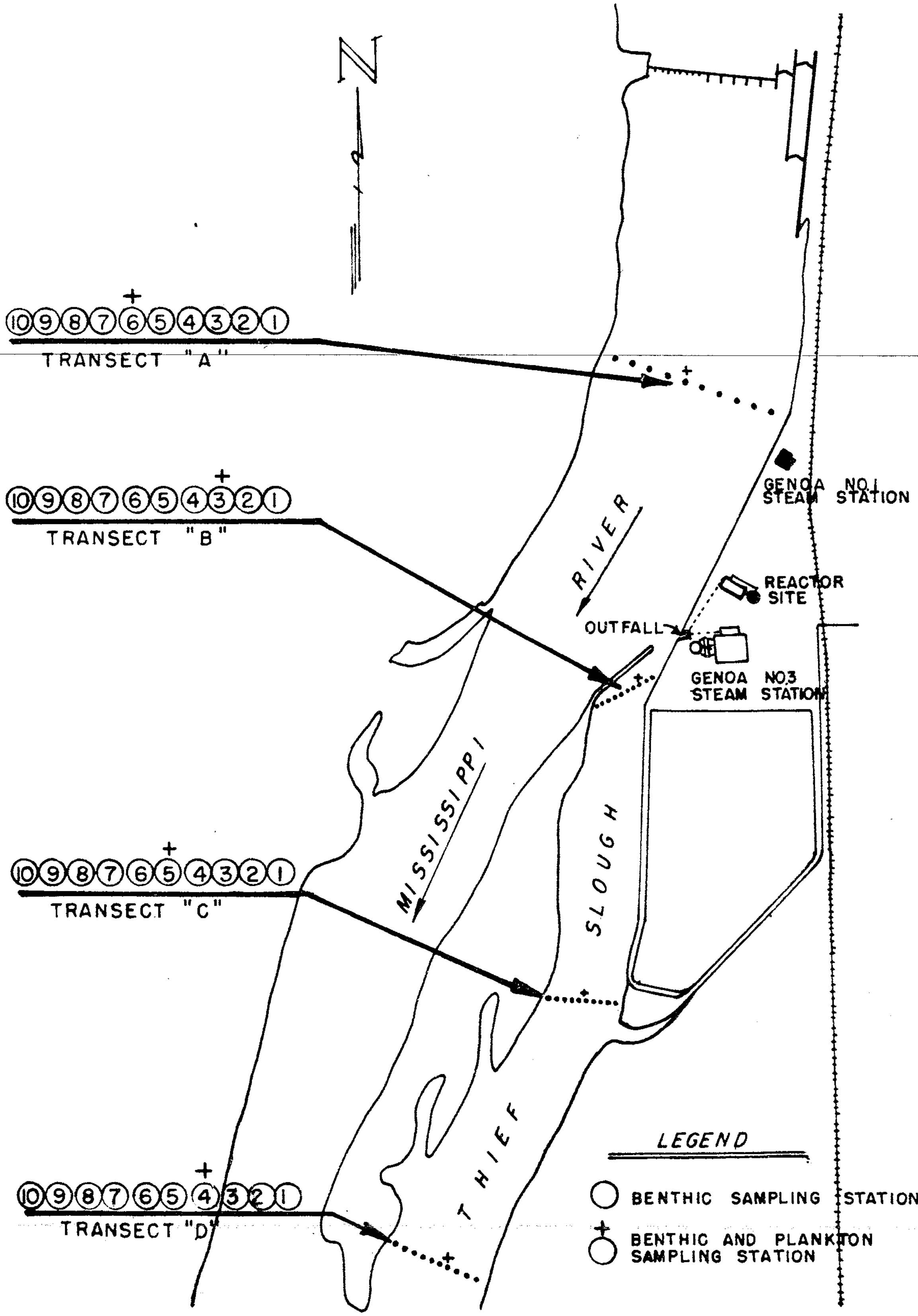

Fig. 5.3-2. Locations of Aquatic Sampling Transects.

From the slough entrance the discharge is assumed to follow the channel bank and to spread linearly with distance until the full width and depth of the channel are covered at the end of Zone A. Mixing within the plume is assumed complete so that any plane perpendicular to flow direction is isothermal.

Calculations of the initial discharge plume cross sections, the cross sections for the ΔT = 5° isotherm, final temperatures, and other data are given in Table 5.3-4 for the 10-year, 7-day minimum river flow and average river flow. Conditions are specified for both the Genoa 3 fossil plant and LACBWR together and for LACBWR alone.

Fogs due to warm water under a cold air layer are generally thin and unstable. Since for LACBWR the hot water is very rapidly mixed with river water as well as being a relatively small discharge, the fogging effect should be very small.

Table 5.3-4. Results of Staff's Plume Analysis

	At Zone A Entrance (depth = 10 ft)		At 5°F Isotherm			
	Area of Plume Cross Section (ft^2)	Fraction of Total Cross Section (%)	Area of Plume Cross Section (ft^2)	Fraction of Total Cross Section (%)	Distance from Discharge (ft)	Final Temp. Change (ΔT, °F)
Minimum flow						
LACBWR & Genoa 3	680	38	4500	100	580	4.9
LACBWR only	180	10	730	25	210	1.3
Average flow						
LACBWR & Genoa 3	154	8	600	22	186	1.0
LACBWR only	40	2	116	6	76	0.25

5.4 WATER QUALITY STANDARDS

The Wisconsin administrative code[3] classifies the Mississippi River for commercial and recreational fishing, boating, and hunting, and other less restrictive uses. The mixing zone according to State law is defined as the region where State water quality standards are exceeded. Every point outside must meet State standards. Where possible the mixing zone should be no larger than 25% of the cross-sectional area and not extend more than 50% of the width of the stream. Temperature changes that adversely affect aquatic life should not occur and the maximum temperature rise at the edge of the mixing zone should not exceed 5°F for streams. The 96-hour TLM must not be exceeded at any point and the temperature should not exceed 89°F for a warm-water fish area. The worst condition the limitations must satisfy is for the 7-day, 10-year low flow. While no definite size is specified for the mixing zone, it is required to be as small as practicable.

Since the slough and main channel are taken as a single unit, the area restrictions are automatically satisfied since the slough is taken as 25% of the whole and the exit temperature does not exceed 5° at worst. For discharge of LACBWR alone, the ΔT = 5° isotherm covers at most 25% of the slough and the standard is not violated.

Under conditions where one rather than two cooling pumps operate for each plant (the pumps do not operate at fractional capacities), the ΔT of the cooling water is approximately doubled. However, the total heat output is the same and is limited by the reactor or coal-burner capacity. Consequently, aside from a possible momentary generator tripout or other disturbance, the normal discharge temperatures cannot be exceeded by more than a few percent over an extended time period. With the flow from only one pump discharging into the slough more dilution water can enter, and although the initial plume temperatures are higher, the final temperatures and the cross-sectional areas will be smaller than before.

5.5 RADIOLOGICAL IMPACTS FROM ROUTINE OPERATION

5.5.1 Exposure Pathways

The environmental pathways which were considered in preparing this section are shown in Figure 5.5-1. The specific pathways evaluated were:

1. Direct radiation from the plant

2. For gaseous effluents:

   a. Immersion in the gaseous plume
   b. Inhalation of iodines and particulates
   c. Ingestion of iodines and particulates through the milk cow, goat, meat animal and vegetation pathway
   d. Radiation from iodines and particulates deposited on the ground

3. For liquid effluents:

   a. Drinking water
   b. Ingestion of fish and invertebrates
   c. Shoreline activities, boating and swimming in water containing radioactive effluents.

Only those pathways associated with gaseous effluents which were reported to exist at a single location were combined to calculate the total exposure to a maximally exposed individual. Pathways associated with liquid effluents were combined without regard to location but were assumed to be associated with a maximally exposed individual other than the individual from gaseous effluent pathways.

The models and considerations for environmental pathways leading to estimates of radiation doses to individuals near the plant and to the population within an 80-km radius of the plant resulting from plant operations are discussed in detail in Regulatory Guide 1.109. Use of these models with additional assumptions for environmental pathways leading to exposure to populations outside the 80-km radius are described in Appendix E of this statement.

5.5.2 Dose Commitments

The quantities of radioactive material that may be released annually from the plant are estimated and presented in Section 3.6. The applicant's site and environmental data provided in the environmental report and in subsequent answers to NRC staff questions are used extensively in the dose calculations. Using these quantities of radioactive materials released and exposure pathway information, the dose commitments to individuals and the population are estimated. Population doses are based on the population distribution for the year 1970. Projected population distributions for 15-year midlife of the plant, 1983, were not requested due to the low man-rem doses calculated in Table 5.5-4 and the fact that the region is expected to grow less than 5 percent by the year 2010.

The dose commitments in this statement represent the total dose received over a period of 50 years following the intake of radioactivity for one year under the conditions existing 15 years after the station is started up. For the younger age groups, changes in organ mass with age after the initial intake of radioactivity are accounted for in a stepwise manner.

In the analysis of all effluent radionuclides released from the plant, tritium, carbon-14, radiocesium, radiocobalt, radioiodine, and the noble gases, on the ground plane, in the gas plume, inhaled with air and ingested with food and water were found to account for essentially all total-body dose commitments to individuals and the population within 80 km of the plant.

Dose Commitments from Radioactive Releases to the Atmosphere

Radioactive effluents released to the atmosphere from the La Crosse facility will result in small radiation doses to individuals and populations. NRC staff estimates of the expected gaseous and particulate releases listed in Tables 3.6-2 and 3.6-3 and the site meteorological considerations discussed in Section 2.6 of this statement and summarized in Table 5.5-2 were used to estimate radiation doses to individuals and populations. The results of the calculations are discussed below.

(1) Radiation Dose Commitments to Individuals

Individual receptor locations and pathway locations considered for the maximum individual are listed in Table 5.5-1. The estimated dose commitments to the maximum individual from radioiodine and particulate releases at selected offsite locations are listed in Tables 5.5-3 and 5.5-4. The maximum individual is assumed to consume well above average quantities of the foods considered (see Table E-5 in Regulatory Guide 1.109).

The maximum annual beta and gamma air dose and the maximum total body and skin dose to an individual, at the maximum site boundary, are presented in Tables 5.5-3 and 5.5-4.

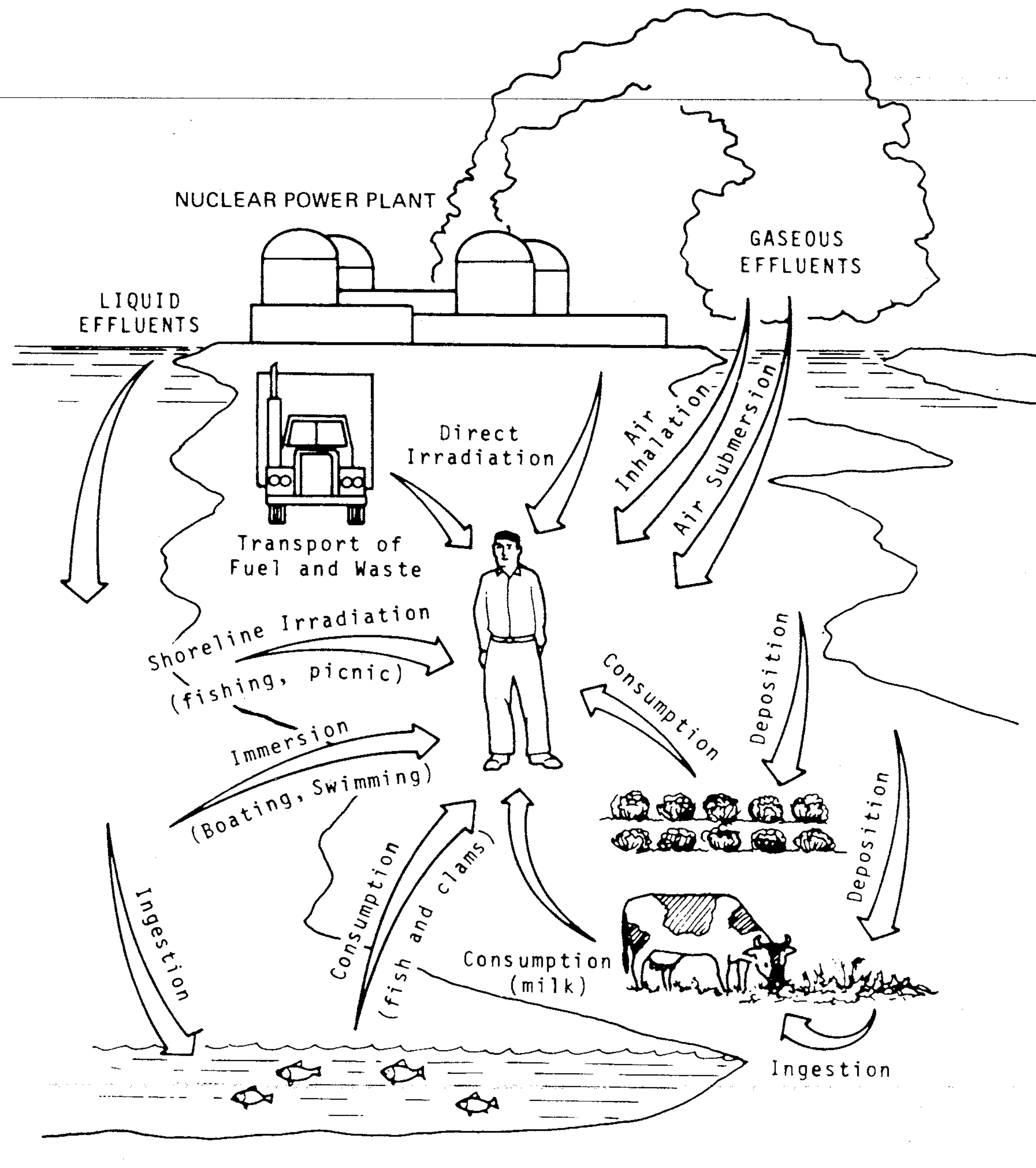

Fig. 5.5-1. Exposure Pathways to Man.

(2) Radiation Dose Commitments to Populations

The estimated annual radiation dose commitments to the population within 80 km of the La Crosse nuclear plant from gaseous and particulate releases are shown in Table 5.5-4. Beyond 80 km, the doses were evaluated using average population densities and food production values discussed in Appendix E. Estimated dose commitments to the U.S. population are shown in Table 5.5-5. Background radiation doses are provided for comparison. The dose commitments from atmospheric releases from the La Crosse facility during normal operation represent a small increase in the normal population dose due to background radiation sources.

Dose Commitments from Radioactive Liquid Releases to the Hydrosphere

Radioactive effluents released to the hydrosphere from the La Crosse facility during normal operation will result in small radiation doses to individuals and populations. NRC staff estimates of the expected liquid releases listed in Table 3.6-2 and the site hydrological considerations discussed in Section 2.5 of this statement and summarized in Table 5.5-6 were used to estimate radiation dose commitments to individuals and populations. The results of the calculations are discussed below.

(1) Radiation Dose Commitments to Individuals

The estimated dose commitments to the maximum individual from liquid releases at selected off-site locations are listed in Tables 5.5-3 and 5.5-4. The maximum individual is assumed to consume well above average quantities of the foods considered and spend more time at the shoreline than the average person (see Table E-5 in Regulatory Guide 1.109).

(2) Radiation Dose Commitments to Populations

The estimated annual radiation dose commitments to the population within 80 km of the La Crosse nuclear plant from liquid releases, based on the use of water and biota from the Mississippi River, are shown in Table 5.5-4. Dose commitments beyond 80 km were based on the assumptions discussed in Appendix E. Estimated dose commitments to the U.S. population are shown in Table 5.5-5. Background radiation doses are provided for comparison. The dose commitments from liquid releases from the La Crosse facility during normal operation represent a small increase in the normal population dose due to background radiation sources.

Direct Radiation

(1) Radiation from the Facility

Radiation fields are produced in nuclear plant environs as a result of radioactivity contained within the reactor and its associated components. Although these components are shielded, dose rates around the plants have been observed to vary from undetectable levels to values of the order of 1 rem/year.

Doses from sources within the plant are primarily due to nitrogen 16, a radionuclide produced in the reactor core. For boiling water reactors, nitrogen-16 is transported with the primary coolant to the turbine building. The orientation of piping and turbine components in the turbine building determines, in part, the exposure rates outside the plant. Because of variations in equipment lay-out, exposure rates are strongly dependent upon overall plant design.

Based on the radiation surveys which have been performed around several operating BWRs, it appears to be very difficult to develop a reasonable model to predict direct shine doses. Thus, older plants should have actual measurements performed if information regarding direct radiation and sky-shine rates is needed.

Low level radioactivity storage containers outside the plant are estimated to contribute less than 0.01 mrem/year at the site boundary.

(2) Occupational Radiation Exposure

Based on a review of the applicant's safety analysis report, the staff has determined that the applicant is committed to design features and operating practices that will assure that individual occupational radiation doses can be maintained within the limits of 10 CFR Part 20 and that individual and total plant population doses

will be as low as is reasonably achievable.* For the purpose of portraying the radiological impact of the plant operation on all on-site personnel, it is necessary to estimate a man-rem occupational radiation dose. For a plant designed and proposed to be operated in a manner consistent with 10 CFR Part 20, there will be many variables which influence exposure and make it difficult to determine a quantitative total occupational radiation dose for a specific plant. Therefore, past exposure experience from operating nuclear power stations**has been used to provide a widely applicable estimate to be used for all light water reactor power plants of the type for La Crosse. This experience indicates a value of 600 man-rem per year per reactor unit.

Annual occupational exposure rates at LACBWR reported from 1973-1978 varied from a high of 1.59R per worker to a low of 0.9R per worker with the average dose being 1.17R per worker. Reported average doses per worker for the same period at other small plants were 0.69 (Big Rock Point - 72 MW); 1.45 (Humboldt Bay - 65 MW); 1.06 (Nine Mile Point - 620 MW) and 0.89 (Oyster Creek - 650 MW). The average man-rems per year reported for LACBWR ofr the 1970-1978 period is 156.[7]

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(3) Transportation of Radioactive Material

The transportation of cold fuel to a reactor, of irradiated fuel from the reactor to a fuel reprocessing plant, and of solid radioactive waste from the reactor to burial grounds is within the scope of the NRC report entitled, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants." The estimated population dose commitments associated with transportation of fuels and wastes are listed in Tables 5.5-5 and 5.5-7.

5.5.3 Radiological Impact on Man

The actual radiological impact associated with the operation of the proposed La Crosse nuclear power station will depend, in part, on the manner in which the radioactive waste treatment system is operated. Based on the NRC staff's evaluation of the potential performance of the radwaste system, it is concluded that the system as proposed is capable of meeting the dose design objectives of 10 CFR Part 50, Appendix I. Table 5.5-4 compares the calculated maximum individual doses to the dose design objectives. However, since the facility's operation will be governed by operating license technical specifications and since the technical specifications will be based on the dose design objectives of 10 CFR Part 50, Appendix I, as shown in the first column of Table 5.5-4, the actual radiological impact of plant operation may result in doses close to the dose design objectives. Even if this situation exists, the individual doses will still be very small when compared to natural background doses (∿ 100 mrem/yr) or of the dose limits specified in 10 CFR Part 20. As a result, the staff concluded that there will be no measurable radiological impact on man from routine operation of the plant.

*The concept of maintaining occupational radiation exposures ALARA does not embody a specific numerical guideline
value at the present time. Rather, it is a philosophy that reflects specific objectives for radiation dose management in:

1. Establishing a program to maintain occupational radiation exposures ALARA;
2. Designing facilities and selecting equipment;
3. Establishing a radiation control program, plans, and procedures; and
4. Making supporting equipment, instrumentation, and facilities available.

The maximum dose to individuals, as well as the collective dose to the group (measured in man-rems) must be kept as low as is reasonably achievable. The term "as low as is reasonably achievable" is defined in paragraph 20.1(c) of 10 CFR Part 20 to mean "as low as is reasonably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other socioeconomic consideration...."

If design reviews or inspections had revealed that radiation exposures at nuclear power stations were unavoidable or that the cost of reducing the exposures would be unreasonable, the exposures might be considered ALARA by definition. However, this has not always been the case. Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will be as Low as is Reasonably Achievable" contains a series of procedures and design objectives which are intended to maintain occupational radiation exposures ALARA if implemented. These objectives concern such variables as fuel integrity, buildup and deposition; equipment reliability; station layout; and radiation protection programs. These objectives are obtainable with current technology, although the cost of obtaining them may vary depending on the features of the specific power reactor facility and the method selected to accomplish the objective. The end result of implementing these features is reducing occupational radiation exposures to levels which are as low as is reasonably achievable.

**NUREG-0323 Occupational Radiation Exposures at Light Water Cooled Power Reactors 1969-1976, March 1978.

Effective December 1, 1979, the licensee has been regulated according to the Environmental Protection Agency's 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations, which specifies that the annual dose equivalent does not exceed 25 mrems to the whole body, 75 mrems to the thyroid, and 25 mrems to any other organ of any member of the public as the result of exposures to planned discharges of radioactive materials, radon and its daughters excepted, to the general environment from uranium fuel cycle operations and radiation from these operations.

5.5.4 Radiological Impacts to Biota Other than Man

Depending on the pathway and radiation source, terrestrial and aquatic biota will receive doses approximately the same or somewhat higher than man receives. Although guidelines have not been established for acceptable limits for radiation exposure to species other than man, it is generally agreed that the limits established for humans are also conservative for other species. Experience has shown that it is the maintenance of population stability that is crucial to the survival of a species, and species in most ecosystems suffer rather high mortality rates from natural causes. While the existence of extremely radiosensitive biota is possible, and whereas increased radiosensitivity in organisms may result from environmental interactions with other stresses (e.g., heat, biocides, etc.), no biota have yet been discovered that show a sensitivity (in terms of increased morbidity or mortality) to radiation exposures as low as those expected in the area surrounding the La Crosse nuclear power plant. Furthermore, in all the plants for which an analysis of radiation exposure to biota other than man has been made, there have been no cases of exposures that can be considered significant in terms of harm to the species, or that approach the exposure limits to members of the public permitted by 10 CFR Part 20.* Since the BEIR Report** concluded that the evidence to date indicates that no other living organisms are very much more radiosensitive than man, no measurable radiological impact on populations of biota is expected as a result of the routine operation of this plant.

5.6 NONRADIOLOGICAL EFFECTS ON ECOLOGICAL SYSTEMS

5.6.1 Terrestrial

Operation of the plant has had no noticeable adverse effects on the nearby plants and animals.[17] The only sounds created by the plant that are audible at the site boundary are those of the turbines and transformer. These sounds are not loud enough to interfere with normal conversation within the site boundary and are barely discernible at the perimeter of the exclusion area. Plant operation also appears to have had no adverse effects on waterfowl use of Pool 9. Use of the pool by waterfowl has increased from an average of 3.4 million use days per year during 1965-1971 to an average of 6.0 million use days per year during 1972-1977.[17]

5.6.2 Aquatic

Three aquatic biological studies have been performed in the vicinity of the LACBWR. Data of fish populations were obtained by electrofishing in the upper part of Thief Slough from August 1969 through March 1970. The highest numbers of fish collected in the mixing zone below the discharge occurred from August to October in 1969 and during March 1970. Lowest numbers were collected from November to February.[1] This may indicate that the fish seek deeper water in winter, since the collecting equipment used (230-V ac boomshocker) is not effective in deep water.

A survey of phytoplankton, zooplankton, and benthos was conducted in June 1972 on a transect upstream from the LACBWR intake, and on three transects across Thief Slough below the combined outfalls from Genoa 3 and the LACBWR.[2]

*B.G. Blaylock and J. P. Witherspoon, "Radiation Doses and Effects Estimated for Aquatic Biota Exposed to Radioactive Releases from LWR Fuel-Cycle Facilities," Nucl. Safety 17:351 (1976).

**"The Effects on Populations of Exposure to Low Levels of Ionizing Radiation" (BEIR Reports), NAS-NRC, 1972.

Table 5.5-1

RECEPTOR AND PATHWAY LOCATIONS CONSIDERED FOR SELECTING
MAXIMUM INDIVIDUAL DOSE COMMITMENTS

	Sector	Distance (miles)
Site Boundary[a]	S	0.34
Residence[b]	ESE	0.50
Garden	ESE	0.50
Milk Cow	ENE	0.62
Milk Goat	E	2.3
Meat Animal	SE	1.4
Location of Maximum χ/Q	SSE	0.75

[a]Beta and Gamma air doses, total body and skin doses from noble gases are determined at site boundaries.

[b]Dose pathways including inhalation of atmospheric radioactivity, exposure to deposited radionulcides and submersion in gaseous radioactivity are evaluated at residences.

Table 5.5-2

SUMMARY OF ATMOSPHERIC DISPERSION FACTORS AND DEPOSITION
VALUES FOR MAXIMUM SITE BOUNDARY AND RECEPTOR LOCATIONS
NEAR THE LA CROSSE NUCLEAR POWER STATION[a]

LOCATION	SOURCE	X/Q (sec/m^3)	RELATIVE DEPOSITION (M^{-2})
Maximum χ/Q (SSE, 0.75)	A	3.5×10^{-6}	4.6×10^{-8}
	B	1.1×10^{-5}	1.4×10^{-7}
Nearest Site Land Boundary[b] (S, 0.34 mi)	A	3.1×10^{-8}	1.1×10^{-9}
	B	1.1×10^{-7}	3.8×10^{-8}
Nearest Residence, Milk Animal (ENE, 0.62 mi)	A	9.4×10^{-7}	8.7×10^{-9}
	B	1.6×10^{-5}	1.5×10^{-7}

Source A is the continuous stack releases.
Source B is the intermittent stack releases.

[a]The dose presented in the following tables are corrected for radioactive decay and cloud depletion from deposition, where appropriate, in accordance with Regulatory Guide 1.111, Rev. 1 "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Reactors," July 1977.

[b]"Nearest" refers to that type of location where the highest radiation dose is expected to occur from all appropriate pathways.

Table 5.5-3

ANNUAL DOSE COMMITMENTS TO A MAXIMUM INDIVIDUAL NEAR THE LA CROSSE PLANT

LOCATION	PATHWAY	DOSES (mrem/yr/unit)			
		Noble Gases in Gaseous Effluents			
		Total Body	Skin	Gamma Air Dose (mrad/yr/unit)	Beta Air Dose (mrad/yr/unit)
Maximum χ/Q Location[a] (SSE, 0.75 miles)	Direct Radiation From Plume	3.7	7.4	5.6	3.8
		Iodine and Particulates in Gaseous Effluents			
		Total Body	Thyroid	Bone	
Nearest[b] Residence, Milk Cow at 0.62 mi. ENE	Ground Deposit	c	c	c	
	Inhalation	c	0.02	c	
	Milk (to a receptor)	0.20	2.2	0.93	
		Liquid Effluents			
		Total Body	Thyroid	GI Tract - Lower Large Intestine	
Nearest Drinking Water at Pool No. 9	Water Ingestion	0.006	0.012	0.016	
Nearest Fish at South end of Thief Slough	Fish Ingestion	0.65	0.018	0.76	

[a] "Nearest" refers to that site boundary location where the highest radiation doses due to gaseous effluents have been estimated to occur.

[b] "Nearest" refers to the location where the highest radiation dose to an individual from all applicable pathways has been estimated.

[c] Less than 0.01 mrem/yr.

Table 5.5-4

CALCULATED DOSE COMMITMENTS TO A MAXIMUM INDIVIDUAL AND THE POPULATION FROM THE LA CROSSE NUCLEAR PLANT OPERATION[a]

	APPENDIX I DESIGN OBJECTIVES	CALCULATED DOSES
MAXIMUM INDIVIDUAL DOSES		
	Annual Dose Per Reactor Unit	
Liquid Effluents		
Dose to total body from all pathways	3 mrem	0.7 mrem
Dose to any organ from all pathways	10 mrem	0.8 mrem (lower large intestine)
Noble Gas Effluents (at maximum χ/Q location)		
Gamma dose in air	10 mrad	5.6 mrad
Beta dose in air	20 mrad	3.8 mrad
Dose to total body of an individual	5 mrem	3.7 mrem
Dose to skin of an individual	15 mrem	7.4 mrem
Radioiodines and Particulates[b]		
Dose to any organ from all pathways	15 mrem	2.2 mrem (thyroid)

	POPULATION DOSES WITHIN 80 km (50 mi) TOTAL BODY	THYROID
	Annual Dose Per Reactor Unit	
Natural Radiation Background[c]	29,000 man-rem	
Liquid Effluents	1.7 man-rem	0.03 man-rem
Noble Gas Effluents	0.56 man-rem	0.56 man-rem
Radioiodines and Particulates	0.16 man-rem	0.59 man-rem

[a] Appendix I Design Objectives from Sections II.A, II.B, II.C and II.D of Appendix I, 10 CFR Part 50, considers doses to maximum individual and population per reactor unit. From Federal Register V. 40, p. 19442, May 5, 1975.

[b] Carbon-14 and tritium have been added to this category.

[c] "Natural Radiation Exposure in the United States," U.S. Environmental Protection Agency, ORP-SID-72-1 (June 1972); using the average Minnesota/Wisconsin state background dose (87 mrem/yr), and year 1970 population of 330,000.

Table 5.5-5

ANNUAL TOTAL BODY POPULATION DOSE COMMITMENTS IN THE YEAR 1970

CATEGORY	U.S. POPULATION DOSE COMMITMENT
Natural Background Radiation[a] (man-rem/yr)	21,000,000
La Crosse Nuclear Plant Operation (man-rem/yr/site)	
Plant Workers	600
General Public:	
Radioiodine and Particulates	27
Liquid Effluents	7
Noble Gas Effluents	1.6
Transportation of Fuel and Waste	7

[a]Using the average U.S. background dose (100 mrem/yr) in (a), and year 1970 U.S. population from "Population Estimates and Projections," Series II, U.S. Department of Commerce, Bureau of the Census, Series P-25, No. 541 (Feb. 1975).

Table 5.5-6

SUMMARY OF HYDROLOGIC TRANSPORT AND DISPERSION FOR LIQUID RELEASES FROM THE LA CROSSE NUCLEAR POWER STATION[a]

LOCATION	TRANSIT TIME (Hours)	DILUTION FACTOR
Nearest Drinking Water Intake (Pool No. 9)	22	356
Nearest Sport Fishing Location (South end of Thief Slough)	1.1	107

[a]See Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

Table 5.5-7

ENVIRONMENTAL IMPACT OF TRANSPORTATION OF FUEL AND WASTE TO AND FROM ONE LIGHT-WATER-COOLED NUCLEAR POWER REACTOR

Normal Conditions of Transport

Heat (per irradiated fuel cask in transit)	260 MJ/hr
Weight (governed by Federal or State restrictions)	33,000 kg. per truck; 90 tonnes per cask per rail car
Traffic density:	
Truck	< 1 per day
Rail	< 3 per month

Exposed population	Estimated number of persons exposed	Range of doses to exposed individuals[a] (millirems per reactor year)	Cumulative dose to exposed population (man-rems per reactor) year)[b]
Transportation Worker	200	0.01 to 300	4
General Public:			
Onlookers	1,100	0.003 to 1.3	
Along Route	600,000	0.0001 to 0.06	3

Accidents in Transport

Radiological Effects	Small[c]
Common (nonradiological) causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year

[a]The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5,000 millirems/year for individuals as a result of occupational exposure and should be limited to 500 millirems/year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 millirems/year.

[b]Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1,000 people were to receive a dose of 0.001 rem (1 millirem), or if 2 people were to receive a dose of 0.5 rem (500 millirems) each, the total cumulative dose in each case would be 1 man-rem.

[c]Although the environmental risk of radiological effects stemming from transportation accidents cannot currently be numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multi-reactor site.

Source: Data supporing this table are given in the Commission's Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238, December 1972, and Supplement I, NUREG-75/038, April 1975. The number "130 millirem in note "a" to this table is not in current use. About 100 millirem/yr is currently used for average background radiation in the U.S.

No significant differences in phytoplankton diversity or zooplankton species composition and abundances were observed among the transects. The data on benthos suggest lower diversity at the downstream transects, but no trend toward decreased biomass of benthos was observed. Although this short survey was inadequate to define seasonal differences in biological impact, it indicated that major perturbations were not detectable during the period of study. No primary productivity studies have been done.

Additional studies to determine the aquatic ecological impact of thermal discharges at the Genoa Generating Station (including LACBWR) were conducted from June 1974 to June 1975.[6] Water quality parameters (e.g., thermal mapping, dissolved oxygen, water color, and turbidity) were investigated in conjunction with studies on phytoplankton, zooplankton, fish larvae, and egg entrainment mortality. Fish impingement, benthos, and fish surveys were also made.

Thermal mapping showed that the discharge plume and mixing zone were within requirements of State law (see Section 5.4). The dissolved oxygen concentration at the discharge was generally lower than ambient river levels, but it was never lower then 5 ppm (the State water quality standard). Ambient concentration was found within the mixing zone. Water color and turbidity showed no consistent differences between intake and discharge areas.

Intensified sampling of phytoplankton and zooplankton was conducted during five-day intervals in August 1974, October 1974, March 1975, and June 1975 at upstream and downstream transects. No statistically significant differences between transects were observed for phyto-zooplankton abundance, community structure, or total plankton biomass.

The entrainable biota include phytoplankton, zooplankton, drift invertebrates, and fish eggs and larvae. These organisms are subject to mechanical and thermal stress during condenser passage, and to the toxic effects of chlorine used in the Genoa 3 plant. Phytoplankton entrainment studies showed an average of 18.4% dead phytoplankton in the intake water. The average in the discharge water was 21.5%. Zooplankton entrainment mortality was greater. Dead zooplankton in the intake averaged 24% while an average of 45% was dead in the discharge water.

At most, about 2.5% of the 7-day, 10-year low flow of the entire river passes through LACBWR. If 100% mortality is conservatively assumed to occur due to passage of entrained organisms through the station, about 2.5% of the river's entrainable biota will be killed. If we assume on the other hand that death is due only to exposure of the LACBWR entrained organisms to the highly toxic chlorinated effluent of Genoa 3, the chlorination period (twice daily for 20 minutes) will result in about 0.1% mortality. Consequently, under low flow conditions, mortality will lie somewhere between 0.1% and 2.5%, and under normal flow conditions the percentage of mortality will be less. Such organisms that are killed would be available as particulate food to other organisms until decomposition, at which point their nutrients would be released and available. At this low mortality range, no damage of importance to river populations is expected.

Upstream vs. downstream dredge samples showed little difference in abundance of benthic organisms per unit area of sediment. The applicant collected benthos in artificial substrate samplers[6] from upstream, downstream, and in the discharge area which showed little difference in abundance or number of species. The diversity in the discharge area was lowest. Insect larvae were reduced in the discharge area where temperatures occasionally exceed 30°C (86°F) which is above the average TL_m (96 hr) for many aquatic insect larvae in temperate climates.[19] Populations of insect larvae were restored somewhat in the downstream samples, suggesting that the thermal effects are limited to the discharge and mixing zone areas. Other factors, such as variations in current velocity and sediment type, may also be involved in the differences between transects. However, no evaluation based on differences in benthic habitat type or current velocity can be provided since these parameters were not investigated.

The 1974-1975 electrofishing surveys served to evaluate fish distribution and community structure in upstream, discharge, and downstream areas.[18] Catch rates were consistently higher in the discharge area, where habitat suitability was subjectively evaluated as low to marginal. Fish were attracted to the discharge area and greatest electrofishing success occurred when the water temperature was between 10°C and 20°C (50°F and 68°F). During colder months, electrofishing success was low in all areas; but some attraction to the discharge area was noted. Walleye were particularly attracted to the discharge area, while redhorse sucker avoided the discharge area when temperatures were above 20°C (68°F). Use of rock fill has improved fish habitat along the shoreline in the LACBWR vicinity, which may have attracted fish to the area.

Investigation of fish impingement at LACBWR showed an annual average of less than 5 fish per hour. Based on average weight and number of fish impinged per month, the annual weight of total impinged fish is about 360 lbs. This represents about 10% of the average annual harvest of fish by one commercial fisherman. Survival analyses on impinged fish at the site suggest that 20-80% of these fish survive impingement and are returned to the river by screen washing. The survival rate depends upon species. The most frequently impinged species were bluegill, freshwater drum, and emerald shiner. These species are prolific egg producers and may suffer natural losses of

about 50% of the eggs per year in the river systems.[8] Impingement of fish does not appear to cause a substantial loss to fish populations, and the intake structure and velocity are acceptable to the staff.

A survey conducted from March through June showed that 5000 to 938,000 fish eggs and fry were entrained per day at the Genoa 3 intake. The major species was white bass. This species is a prolific breeder; one white bass can produce as many as 1,000,000 eggs per spawning season. Since the LACBWR requires 1/3 the cooling water of the Genoa 3 station, one could conservatively estimate entrainment losses of eggs and fry at the LACBWR as 1/3 the values reported for Genoa 3 station. This impact may result from a combination of mechanical, thermal, or chemical (chlorine) effects on the eggs and fry; losses from the whole river would be similar to the 2.5% (assuming 100% mortality) calculated for phyto-zooplankton, previously described. Although there is probably 100% mortality of entrained eggs and fry, there has been no measureable damaging effect on harvestable fish crops. Commercial fishing data from pools No. 8 and No. 9 seem to substantiate the opinion that there is no widespread or long-term damage (see Table 2.7-2).

Another potential thermal problem with a once-through cooled plant is the possibility of winter fish kills due to thermal shock when fish attracted to the heated effluent are rapidly exposed to ambient temperatures on shutdown of the station. In the event of a rapid shutdown of LACBWR the fish will, under most circumstances, still be exposed to the heated effluent of the Genoa 3 plant. Thus, the combined discharge of LACBWR and the Genoa 3 plant is an advantage in this respect.

It is widely recognized that residual chlorine at even very low concentrations can have adverse impacts on biota, ranging from increased mortality to decreased primary productivity.[9] While LACBWR itself does not chlorinate, organisms entrained by the nuclear plant will be periodically exposed to high chlorine levels of the Genoa 3 discharge. The transit time of an organism entrained by LACBWR will be up to about 100 seconds from first exposure to the chlorine of Genoa 3 to the end of Area A (Fig. 5.2-1). At this point, the total residual chlorine should be no greater than 0.05 ppm, and in actuality should be far less, due to the chlorine demand of the river. The criteria proposed by Brungs[9] suggest that limiting exposure to 0.2 ppm for two hours per day should provide protection to the biota, while the National Academies of Science and Engineering propose a more restrictive 0.05 ppm for a 30-minute period. Given the uncertainties of the chlorine demand and differences in the proposed criteria, a conservative conclusion is that organisms entrained by LACBWR will be exposed to chlorine levels of potentially toxic concentration for approximately 100 seconds. Effects of other potentially toxic effluents, such as chromium, are not expected, since discharge of such materials to the river has been discontinued.

The evidence available to the staff does not show that the operation of LACBWR is having a widespread or long-term impact on the aquatic biota.

5.7 IMPACTS ON PEOPLE

5.7.1 Physical Impacts

The applicant's generating facilities, including LACBWR, are visible from Highway 35 and from a considerable stretch of the Mississippi River, which is used by many people for recreational purposes. Any such intrusion on an otherwise natural setting must be regarded as an adverse impact, although the contribution of LACBWR to the total impact is not large. The fossil-fuel units with their fuel-handling facilities and ash disposal areas attract greater visual attention than the nuclear unit. Similarly, the contribution of LACBWR to the offsite noise level is barely perceptible. Provision of the public river access site and boat-launching facility appears to have compensated for the loss of public access to the river shore occupied by the station, and fishing activities have increased since these facilities were provided. However, ice fishing has been hindered in the discharge area.

5.7.2 Social and Economic Effects

The Dairyland Power Cooperative was established as a result of the Rural Electrification Act of 1936 to supply low-cost electric power to farmsteads, rural homes, and businesses. A reliable power supply is essential to the livelihood of those customers. Although LACBWR provides only about 7% of the applicant's capacity, its output is essential to the maintenance of adequate reserve capacity and system reliability. The need for power is discussed more fully in Section 8.

Apart from this direct benefit, the applicant estimates that taxes paid to local, State, and Federal governments will amount to about $500,000 annually during the life of the plant. The operation and maintenance of LACBWR provides employment for 68 people who live mainly in or near the city of La Crosse. These jobs and the associated payroll income are an appreciable benefit

to the local economy and employment situation. At a meeting with the staff on April 30, 1974, the chairman of the Vernon County Board of Supervisors stated that he knew of no adverse effects on the community from the operation of the plant, nor of any public opposition to its continued operation. The village president of Genoa has not reported any known adverse impacts.

5.8 ENVIRONMENTAL EFFECTS OF THE URANIUM FUEL CYCLE

On March 14, 1977, the Commission presented in the "Federal Register" (42 FR 13803) an interim rule regarding the environmental considerations of the uranium fuel cycle. It is effective through September 13, 1978 and revises Table S-3 of Paragraph (e) of 10 CFR § 51.120.* In a subsequent announcement on April 14, 1978 (43 FR 15613), the Commission further amended Table S-3 to delete the numerical entry for the estimate of radon releases and to clarify that the table does not cover health effects. The revised table is shown here as Table 5.8-1. The interim rule reflects new and updated information relative to reprocessing of spent fuel and radioactive waste management as discussed in NUREG-0116,[10] and NUREG-0216[11] which presents staff responses to comments on NUREG-0116. The rule also considers other environmental factors of the uranium fuel cycle, including aspects of mining and milling, isotopic enrichment, fuel fabrication, and management of low and high level wastes. These are described in the AEC report WASH-1248.[12]

Specific categories of natural resource use are included in Table S-3 of the interim rule. These categories relate to land use, water consumption and thermal effluents, radioactive releases, burial of transuranic and high and low level wastes, and radiation doses from transportation and occupational exposures. The contributions in Table S-3 for reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle); that is, the cycle that results in the greater impact is used. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposition of fuel for nuclear power reactors. The two fuel cycle options that have been considered differ in the treatment of spent fuel removed from a reactor. "No recycle" treats all spent fuel as waste to be stored at a Federal waste repository; "uranium only recycle" involves reprocessing of spent fuel to recover unused uranium and return it to the system. Neither cycle involves the recovery of plutonium.

The no-recycle option is schematically presented in Figure 5.8-1. Natural uranium is mined in either open-pit or underground mines. The ore is transferred to mills where it is processed to produce uranium oxide, or "yellowcake." A conversion facility prepares the uranium oxide from the mills for enrichment by converting it to uranium hexafluoride (UF_6), which is then processed to separate the relatively nonfissile isotope U-238 from the more fissile isotope U-235. At a fuel fabrication facility the enriched uranium, approximately 3% U-235, is then converted to UO_2. The UO_2 is pelletized, sintered, and inserted into tubes to form fuel assemblies. The fuel assemblies are placed in the reactor to produce power. When the content of the U-235 reaches a point where the nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are withdrawn from the reactor. After onsite storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies will be transferred to a Federal repository for interment. Disposal of spent fuel elements in a repository constitutes the final step in the no-recycle option.

A schematic of the uranium-only recycle option is given in Figure 5.8-2. The mining, milling and UF_6 conversion operations are the same as for the no-recycle option, but lesser quantities of materials would be processed. The first difference between the no-recycle and uranium-only recycle options is noted at the enrichment process where the natural UF_6 feed stream is supplemented by recovered, slightly enriched uranium from the reprocessing plant. The combined UF_6 is processed to form UO_2 and fuel assemblies as in the no-recycle option. The second difference between the no-recycle and uranium-only recycle options follows fuel assembly removal from the reactor and onsite storage to permit decay of short-lived fission products and reduced heat generation rates. At this point, the fuel assemblies are transferred to a reprocessing plant for further storage and subsequent processing to recover the residual slightly enriched uranium. Plutonium contained in the spent fuel is considered as waste, will not be recovered, and will be transferred to a Federal repository for disposal along with the transuranic and high-level wastes. These materials will be treated at the reprocessing plant to produce stable materials suitable for final disposal. Disposal of these materials in a repository constitutes the final step in the uranium-only recycle option.

The following assessment of the environment impacts of the fuel cycle as related to the operation of the proposed project is based on the values given in Table S-3 and the staff's analysis of the radiological impact from radon releases. For the sake of consistency, the analysis of

*A notice of final rulemaking proceedings was given in the "Federal Register" of May 26, 1977 (42 FR 26987) that calls for additional public comment before adoption or final modification of the interim rule.

Table 5.8-1 (Table S-3 revised). Summary of Environmental Considerations for the Uranium Fuel Cycle[a] (Normalized to Model LWR Annual Fuel Requirement [WASH-1248] or Reference Reactor Year [NUREG-0116])

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MWe LWR
Natural resource use:		
Land (acres):		
Temporarily committed[b]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to 100-MWe coal-fired powerplant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to 95-MWe coal-fired powerplant.
Water (millions of gallons):		
Discharged to air	160	= 2 percent of model 1000-MWe LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	< 4 percent of model 1000-MWe LWR with once-through cooling.
Fossil Fuel:		
Electrical energy (thousands of MW-hours)	323	< 5 percent of model 1000-MWe LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45-MWe coal-fired powerplant.
Natural gas (millions of scf)	135	< 0.4 percent of model 1000-MWe energy output.
Effluents - chemical (MT):		
Gases (including entrainment):[c]		
SO_x	4,400	
NO_x[d]	1,190	Equivalent to emissions from 45-MWe coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	
Other gases:		
F^-	0.67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards - below level that has effects on human health.

See footnotes at end of table.

Table 5.8-1. (continued)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MWe LWR
Effluents - chemical (MT) (continued)		
HCl	0.014	
Liquids:		
$SO_4^=$	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effects are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3 - 600 cfs. NO_3 - 20 cfs. Fluoride - 70 cfs.
NO_3^-	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10.0	
Fe	0.4	
Tailings solutions (thousands of MT)	240	From mills only - no significant effluents to environment.
Solids	91,000	Principally from mills - no significant effluents to environment.
Effluents - radiological (curies):		
Gases (including entrainment):		
Rn-222	--	Presently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	0.14	Principally from fuel reprocessing plants.
I-129	1.3	
I-131	0.83	
Fission products and transuranics	0.203	

See footnotes at end of table.

Table 5.8-1. (continued)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MWe LWR
Effluents - radiological (curies) (continued)		
Liquids:		
Uranium and daughters	2.1	Principally from milling - included in tailings liquor and returned to ground - no effluents; therefore, no effect on environment.
Ra-226	0.0034	From UF_6 production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants - concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}	
Solids (buried on site):		
Other than high level (shallow)	11,300	9100 Ci comes from low level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning - buried at land burial facilities. 600 Ci comes from mills - included in tailings returned to ground. ∿ 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^{7}	Buried at Federal repository.
Effluents - thermal (billions of British thermal units)	4,063	< 5 percent of model 1000-MWe LWR.

See footnotes at end of table.

Table 5.8-1. (continued)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MWe LWR
Effluents - radiological (curies) (continued)		
Transportation (man-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (man-rem)	22.6	From reprocessing and waste management.

[a]In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of radon-222 from the uranium fuel cycle. These issues which are not addressed at all by the table may be the subject of litigation in the individual licensing procedures.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, April 1974; the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248); and the "Discussion of Comments Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248). The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of § 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

[b]The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

[c]Estimated effluents based on combustion of equivalent coal for power generation.

[d]1.2% from natural gas use and process.

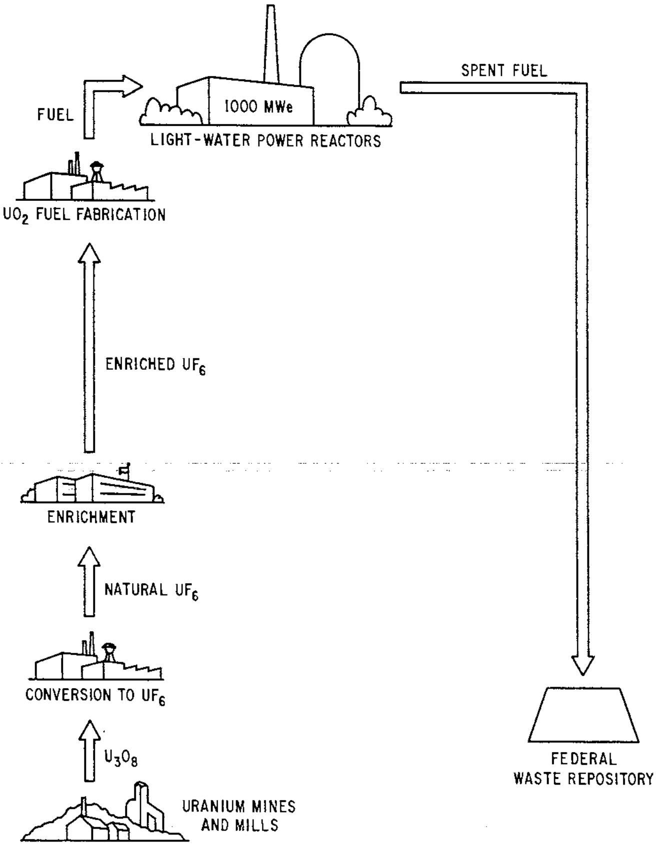

Fig. 5.8-1.

The Uranium Fuel Cycle:
No-Recycle Option.

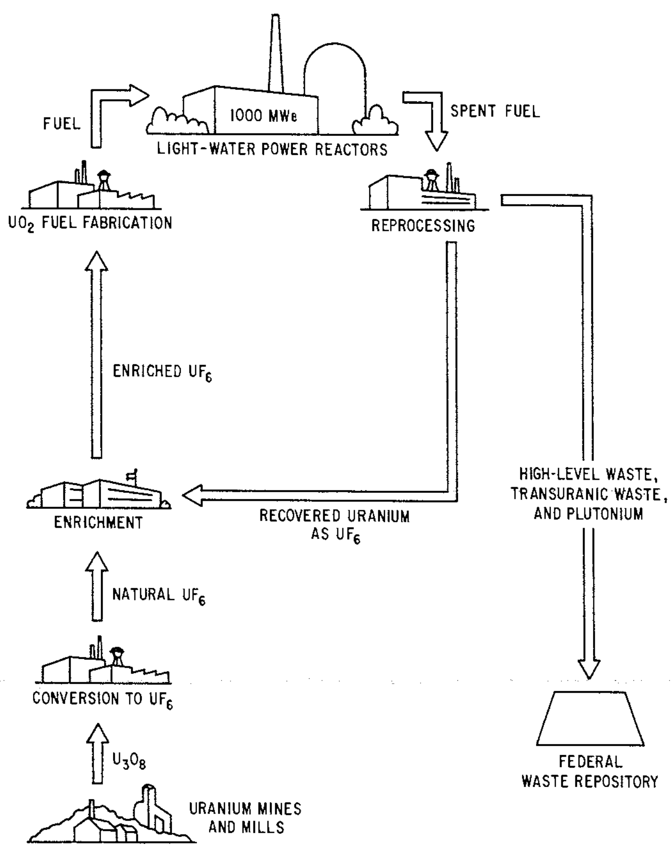

Fig. 5.8-2.

The Uranium Fuel Cycle:
Uranium-Only Recycle
Option.

fuel-cycle impacts has been cast in terms of a model 1000-MWe light-water-cooled reactor (LWR) operating at an annual capacity factor of 80%. In the following review and evaluation of the environmental impacts of the fuel cycle, the staff conclusions would not be altered if the analysis were to be based on the net electrical power output of the proposed project.

The staff's analysis and conclusions are as follows:

5.8.1 Land Use

The total annual land requirement for the fuel cycle supporting a model 1000-MWe LWR is about 46 hectares (113 acres). Approximately five hectares (13 acres) per year are permanently committed land, and 41 hectares (100 acres) per year are temporarily committed. (A "temporary" land commitment is a commitment for the life of the specific fuel-cycle plant, e.g., mill, enrichment plant, or succeeding plants. On abandonment or decommissioning, such land can be used for any purpose. "Permanent" commitments represent land that may not be released for use after plant shutdown and/or decommissioning.) Of the 41 hectares per year of temporarily committed land, 32 hectares are undisturbed and 9 hectares are disturbed. Considering common classes of land use in the U.S.,* fuel-cycle land-use requirements to support the model 1000-MWe LWR do not represent a significant impact.

5.8.2 Water Use

The principal water-use requirement for the fuel cycle supporting a model 1000-MWe LWR is that required to remove waste heat from the power stations supplying electrical energy to the enrichment step of this cycle. Of the total annual requirement of 43×10^6 m^3 ($11,377 \times 10^6$ gal) about 42×10^6 m^3 are required for this purpose, assuming that these plants use once-through cooling. Other water uses involve the discharge to air (e.g., evaporation losses in process cooling) of about 0.6×10^6 m^3 per year and water discharged to ground (e.g., mine drainage) of about 0.5×10^6 m^3 per year.

On a thermal effluent basis, annual discharges from the nuclear fuel cycle are about 4% of the model 1000-MWe LWR using once-through cooling. The consumptive water use of 0.6×10^6 m^3 per year is about 2% of the model 1000-MWe LWR using cooling towers.

The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle used cooling towers) would be about 6% of the model 1000-MWe LWR using cooling towers. Under this condition, thermal effluents would be negligible. The staff finds that these combinations of thermal loadings and water consumption are acceptable relative to the water use and thermal discharges of the proposed project.

5.8.3 Fossil Fuel Consumption

Electrical energy and process heat are required during various phases of the fuel-cycle process. The electrical energy is usually produced by the combustion of fossil fuel at conventional power plants. Electrical energy associated with the fuel represents about 5% of the annual electrical power production of the model 1000-MWe LWR. Process heat is primarily generated by the combustion of natural gas. This gas consumption, if used to generate electricity, would be less than 0.4% of the electrical output from the model plant. The staff finds that the direct and indirect consumption of electrical energy for fuel-cycle operations is small and acceptable relative to the net power production of the proposed project.

5.8.4 Chemical Effluents

The quantities of chemical, gaseous, and particulate effluents with fuel-cycle processes are given in Table S-3. The principal species are SO_x, NO_x, and particulates. Based on data in a Council on Environmental Quality report,** the staff finds that these emissions constitute an extremely small additional atmospheric loading in comparison with these emissions from the stationary fuel-combustion and transportation sectors in the U.S., i.e., about 0.02% of the annual national releases for each of these species. The staff believes such small increases in releases of these pollutants are acceptable.

Liquid chemical effluents produced in fuel-cycle processes are related to fuel-enrichment, -fabrication, and -reprocessing operations and may be released to receiving waters. These effluents are usually present in dilute concentrations such that only small amounts of dilution water are required to reach levels of concentration that are within established standards.

*A coal-fired power plant of 1000-MWe capacity using strip-mined coal requires the disturbance of about 81 hectares (200 acres) per year for fuel alone.

**The Seventh Annual Report of the Council on Environmental Quality, Figures 11-27 and 11-28, pp. 238-239, September 1976.

Table S-3 specifies the flow of dilution water required for specific constituents. Additionally, all liquid discharges into the navigable waters of the United States from plants associated with the fuel-cycle operations will be subject to requirements and limitations set forth in an NPDES permit issued by an appropriate State or Federal regulatory agency.

Tailings solutions and solids are generated during the milling process. These solutions and solids are not released in quantities sufficient to have a significant impact on the environment.

5.8.5 Radioactive Effluents

Radioactive effluents estimated to be released to the environment from reprocessing and waste management activities and certain other phases of the fuel-cycle process are set forth in Table S-3. Using these data, the staff has calculated the 100-year involuntary environmental dose commitment* to the U.S. population. These calculations estimate that the overall involuntary total body gaseous dose commitment to the U.S. population from the fuel cycle (excluding reactor releases and the dose commitment due to radon-222) would be approximately 400 man-rem per year of operation of the model 1000-MWe LWR (RRY).** Based on Table S-3 values, the additional involuntary total body dose commitment to the U.S. population from radioactive liquid effluents due to all fuel-cycle operations other than reactor operation would be approximately 100 man-rem per year of operation. Thus, the estimated involuntary 100-year environmental dose commitment to the U.S. population from radioactive gaseous and liquid releases due to these portions of the fuel cycle is approximately 500 man-rem (whole body) per RRY.

At this time, Table S-3 does not address the radiological impacts associated with radon-222 releases. Principal radon releases occur during mining and milling operations and, following completion of mining and milling, as emissions from stabilized mill tailings and from unreclaimed open-pit mines. The staff has determined that releases from these operations per RRY are as given in Table 5.8-2.

The staff has calculated population dose commitments for these sources of radon-222 using the RABGAD computer code described in NUREG-0002, Appendix A, Section IV.J.[13] The results of these calculations for mining and milling activities prior to reclamation of open-pit mines and tailings stabilization are given in Table 5.8-3.

When added to the 500 man-rem total body dose commitment for the balance of the fuel cycle, the overall estimated total body involuntary 100-year environmental dose commitment to the U.S. population from the fuel cycle for the model 1000-MWe LWR is approximately 600 man-rem. Over this period of time, this dose is equivalent to 0.00002% of the natural background dose of about 3,000,000,000 man-rem to the U.S. population.***

The staff has considered health effects associated with the releases of radon-222, including both the short-term effects of mining, milling, and active tailings, and the potential long-term effects from unreclaimed open-pit mines and stabilized tailings. After completion of active mining, the staff has assumed that underground mines will be sealed, with the result that releases of radon-222 from them will return to background levels. For purposes of providing an upper-bound impact assessment, the staff has assumed that open-pit mines will be unreclaimed and has calculated that if all ore was produced from open-pit mines, releases from them would be 110 Ci/yr per RRY. However, since the distribution of uranium ore reserves available by conventional mining methods is 66.8% underground and 33.2% open pit,[14] the staff has further assumed that uranium to fuel LWRs will be produced by conventional mining methods in these proportions. This means that long-term releases from unreclaimed open-pit mines will be 37 Ci/yr (0.332×110) per RRY.

Based on the above, the radon released from unreclaimed open-pit mines over 100- and 1000-year periods would be about 3700 Ci and 37,000 Ci per RRY, respectively. The total dose commitments for periods of 100, 500, and 1000 years would be as shown in Table 5.8-4. These commitments represent a worst-case situation since no mitigating circumstances are assumed. However, State and Federal laws currently require reclamation of strip and open-pit coal mines and it is very probable that similar reclamation will be required for uranium open-pit mines. If so, long-term releases from such mines should approach background levels.

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*The environmental dose commitment (EDC) is the integrated population dose for 100 years, i.e., it represents the sum of the annual population doses for a total of 100 years. The population dose varies with time, and it is not practical to calculate this dose for every year.

**"RRY" (reference reactor year) will be used in place of "year of operation of the model 1000-MWe LWR."

***Based on an annual average natural background individual dose commitment of 100 mrem and a stabilized U.S. population of 300 million.

Table 5.8-2. Radon Releases from Mining and Milling Operations and Mill Tailings for Each RRY

Source	Radon-222 Release
Mining[a] (during active mining)	4060 Ci
Mining[b] (unreclaimed open-pit mines)	30 to 40 Ci/yr
Milling and tailings[c] (during active milling)	780 Ci
Inactive tailings[c] (prior to stabilization)	350 Ci
Stabilized tailings[c] (for several hundred years)	1 to 10 Ci/yr
Stabilized tailings[c] (after several hundred years)	110 Ci/yr

[a]Testimony of R. Wilde from: "In the Matter of Duke Power Company (Perkins Nuclear Station)," U.S. Nuclear Regulatory Commission, Docket No. 50-488, filed April 17, 1978.

[b]Deposition of Leonard Hamilton, Reginald Gotchy, Ralph Wilde, and Arthur R. Tamplin from: "In the Matter of Long Island Lighting Company (Jamesport Nuclear Power Station)," U.S. Nuclear Regulatory Commission, Docket No. 50-516, p. 9274, July 27, 1978.

[c]Testimony of P. Magno from: "In the Matter of Duke Power Company (Perkins Nuclear Station)," U.S. Nuclear Regulatory Commission, Docket No. 50-488, filed April 17, 1978.

Table 5.8-3. Estimated 100-Year Environmental Dose Commitment for Each RRY

Source	Radon-222 Release (Ci)	Population-Dose Commitment (man-rem)		
		Total Body	Bone	Lung (bronchial epithelium)
Mining	4100	110	2800	2300
Milling and active tailings	1100	29	750	620
Total		140	3600	2900

Table 5.8-4. Population-Dose Commitments from Unreclaimed Open-Pit Mines for Each RRY

Time Period (yr)	Radon-222 Release (Ci)	Population-Dose Commitment (man-rem)		
		Total Body	Bone	Lung (bronchial epithelium)
100	3,700	96	2,500	2,000
500	19,000	480	13,000	11,000
1,000	37,000	960	25,000	20,000

For long-term radon releases from stabilized tailings piles the staff has assumed that these tailings would emit, per RRY, 1 Ci/yr for 100 years, 10 Ci/yr for the next 400 years, and 100 Ci/yr for periods beyond 500 years. With these assumptions, the cumulative radon-222 release from stabilized tailings piles per RRY will be 100 Ci in 100 years, 4,090 Ci in 500 years, and 53,800 Ci in 1000 years.[15] The total body, bone, and bronchial epithelium dose commitments for these periods are shown in Table 5.8-5.

Table 5.8-5. Population-Dose Commitments from Stabilized-Tailings Piles for Each RRY

Time Period (yr)	Radon-222 Release (Ci)	Population-Dose Commitment (man-rem)		
		Total Body	Bone	Lung (bronchial epithelium)
100	100	2.6	68	56
500	4,090	110	2,800	2,300
1,000	53,800	1,400	37,000	30,000

Using risk estimators of 135, 6.9, and 22.2 cancer deaths per million man-rem for total body, bone, and lung exposures, respectively, the estimated risk of cancer mortality due to mining, milling, and active tailings emissions of radon-222 would be about 0.11 cancer fatality per RRY. When the risk due to radon-222 emissions from stabilized tailings over a 100-year release period is added, the estimated risk of cancer mortality over a 100-year period is unchanged. Similarly, a risk of about 1.2 cancer fatalities is estimated over a 1000-year release period per RRY. When potential radon releases from reclaimed and unreclaimed open-pit mines are included, the overall risks of radon induced cancer fatalities per RRY would range as follows:

0.11-0.19 fatality for a 100-year period
0.19-0.57 fatality for a 500-year period
1.2 -2.0 fatalities for a 1000-year period

To illustrate: A single model 1000-MWe LWR operating at an 80% capacity factor for 30 years would be predicted to induce between 3.3 and 5.7 cancer fatalities in 100 years, 5.7 and 17 in 500 years, and 36 and 60 in 1000 years as a result of releases of radon-222.

These doses and predicted health effects have been compared with those that can be expected from natural-background emissions of radon-222. Using data from the National Council on Radiation Protection (NCRP),[16] the average radon-222 concentration in air in the contiguous United States is about 150 pCi/m^3, which the NCRP estimates will result in an annual dose to the bronchial epithelium of 450 mrem. For a stabilized future U.S. population of 300 million, this represents a total lung dose commitment of 135 million man-rem per year. Using the same risk estimator of 22.2 lung cancer fatalities per million man-lung-rem used to predict cancer fatalities for the model 1000-MWe LWR, estimated lung cancer fatalities alone from background radon-222 in the air can be calculated to be about 3000 per year or 300,000 to 3,000,000 lung cancer deaths over periods of 100 and 1000 years, respectively. In addition to the radon-related potential health effects from the fuel cycle, other nuclides produced in the cycle, such as carbon-14, will contribute to population exposures. It is estimated that 0.08 to 0.12 additional cancer death per RRY may occur (assuming that no cure or prevention of cancer is ever developed) over the next 100 to 1000 years, respectively, from exposures to these other nuclides.

The latter exposures can also be compared with those from naturally-occurring terrestrial and cosmic-ray sources. These average about 100 mrem. Therefore, for a stable future population of 300 million persons, the whole-body dose commitment would be about 30 million man-rem per year or 3 billion man-rem and 30 billion man-rem for periods of 100 and 1000 years, respectively. These dose commitments could produce about 400,000 and 4,000,000 cancer deaths during the same time periods. From the above analysis, the staff concludes that both the dose commitments and health effects of the uranium fuel cycle are insignificant when compared to dose commitments and potential health effects to the U.S. population resulting from all natural background sources.

5.8.6 Radioactive Wastes

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) are specified in Table S-3. For low-level waste disposal at land burial facilities, the Commission notes in Table S-3 that there will be no significant radioactive releases to the environment. For high-level and transuranic wastes, the Commission notes that these are to be buried at a Federal repository, and that no release to the environment is associated with such disposal. It is indicated in NUREG-0116,[22] which provides background and context for the high-level and transuranic Table S-3 values established by the Commission, that these high-level and transuranic wastes will be buried and will not be released to the biosphere. No radiological environmental impact is anticipated from such disposal.

5.8.7 Occupational Dose

The annual occupational dose attributable to all phases of the fuel cycle for the model 1000-MWe LWR is about 200 man-rem. The staff concludes that this occupational dose will not have a significant environmental impact.

5.8.8 Transportation

The transportation dose to workers and the public is specified in Table S-3. This dose is small and is not considered significant in comparison to the natural background dose.

5.8.9 Fuel Cycle

The staff's analysis of the uranium fuel cycle did not depend on the selected fuel cycle (no recycle or uranium-only recycle), since the data provided in Table S-3 include maximum recycle option impact for each element of the fuel cycle. Thus, the staff's conclusions as to acceptability of the environmental impacts of the fuel cycle are not affected by the specific fuel cycle selected.

References

1. R.G. Ranthum, Wisconsin Department of Natural Resources, Division of Forestry, Wildlife, and Recreation; Bureau of Fish Management; Management Report No. 48, September 1, 1971.

2. Claflin's Reports are summarized in Section 5.1 of the ER and in the June 15, 1973, Supplement to the ER.

3. Wisconsin Administrative Code, Chapter IV R 102.

4. "Occupational Radiation Exposure to Light Water Cooled Reactors 1969-1974," U.S. Nuclear Regulatory Commission, NUREG-0594, 1978.

5. Responses to Questions, Thomas A. Steele in letter to Ronald L. Ballard, U.S. Nuclear Regulatory Commission, December 12, 1979.

6. "Studies to Determine the Aquatic Ecological Impacts of Thermal Discharges at the Genoa Generating Station," WAPORA, Inc., 100 pp., 1975.

7. A.R. Gaufin and S. Hern, "Laboratory Studies on Tolerance of Aquatic Insects to Heated Waters," J. Kans. Entomol. Soc. 44:240-245, 1971

8. A.J. McClane, "McClane's Standard Fishing Encyclopedia," Holt, Rinehart and Winston, New York, 250 pp., 1965.

9. W.A. Brungs, "Effects of Residual Chlorine on Aquatic Life," J.Water Pollut. Control Fed. 45(10):2180-2193, 1973.

10. "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," U.S. Nuclear Regulatory Commission, NUREG-0116 (Supplement 1 to WASH-1248), October, 1976.

11. "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," U.S. Nuclear Regulatory Commission, NUREG-0216 (Supplement 2 to WASH-1248), March 1977.

12. "Environmental Survey of the Uranium Fuel Cycle, " U.S. Atomic Energy Commission, WASH-1248, April 1974.

13. "Final Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in Light-Water-Cooled Reactors," U.S. Nuclear Regulatory Commission, NUREG-0002, August 1976.

14. "Statistical Data of the Uranium Industry," U.S. Department of Energy, GJO-100(78), January 1, 1978.

15. Testimony of R. Gotchy from: "In the Matter of Duke Power Company (Perkins Nuclear Station)," U.S. Nuclear Regulatory Commission, Docket No. 50-488, filed April 17, 1978.

16. National Council on Radiation Protection and Measurements, Publication 45, 1975.

6. ENVIRONMENTAL MEASUREMENTS AND OPERATIONAL MONITORING PROGRAMS

6.1 HYDROLOGICAL

6.1.1 Chemical Discharge

There has not been an ongoing chemical discharge monitoirng program except that required by the WPDES. However, a single set of chemical analyses of river and discharge waters is reported in the ER. The major chemical effluent of the plant had been the makeup regeneration waste discharge. A single set of analyses for this discharge is shown in Table 3.7-2. However, as discussed in Section 3.7.1, this discharge goes to the Genoa 1 output.

The State of Wisconsin, Department of Natural Resources, has issued a discharge permit for LACBWR in accordance with Wisconsin statutes. The WPDES Permit No. Wi-0003239 requires that discharge flow rate (m^3/day) and total residual chlorine be monitored daily and the recorded information provided to the State as monthly averages. In addition, flows, suspended solids, oil and grease, pH, iron, copper, and various metals in the ash transport system are monitored.

6.1.2 Thermal Discharge

Records are available beginning in January 1969 for condenser cooling water rates of flow and ambient river and condenser discharge temperatures. Since March 1973 a record has been required by the Wisconsin State Department of Natural Resources. This record contains the daily total volume of water discharged, the maximum, minimum, and average temperatures of the intake and discharge at the condenser, average daily temperature differences, and total thermal discharge in Btu.

In compliance with the WPDES Permit, the applicant is required to measure intake and discharge temperature. Monthly maximum, minimum, and mean values will be based on continuous daily monitoring and the results will be provided to the State. In addition, the applicant has been required to monitor the Δ5°F isotherm in the receiving water every three months for one year.

6.2 METEOROLOGICAL

The operational onsite meteorological program at LACBWR consists of instrumentation at several locations in order to minimize the influence of the plant complex and physiography in the vicinity of the plant. Measurements of wind direction, wind speed, and the standard deviation of wind direction fluctuation (σ_Θ) are made at 105-, 30-, and 10-m levels at locations near the plant and at the top of the bluff to the east-southeast of the plant. The wind measurements are not colocated. Ambient temperature measurements are made at the 10-m level and differential temperature measurements are made between the 10- and 105-m levels.

The instrumentation described above was completely installed by August 1976. The accuracy of the instrumentation used to measure meteorological conditions at and near LACBWR meets or surpasses the specifications of USNRC Regulatory Guide 1.23, "Onsite Meteorological Programs."

6.3 ECOLOGICAL

The initial biological monitorings were the Ranthum study of fish populations conducted by the Wisconsin Department of Natural Resources and the Claflin study of planktonic and benthic organisms funded by the applicant. Subsequently, the applicant engaged Wapora, Inc., to conduct a detailed study of the impact of station operation on aquatic biota. From June 1974 until June 1975, the applicant conducted a detailed study of the aquatic impact of operation of LACBWR and Genoa 3. The purpose of the study was to determine the effect of the thermal discharge on the biota of the Mississippi River in the vicinity of the station. The scope of the study included investigation of the effect of the heated effluent on the phytoplankton, zooplankton, macroinvertebrates, and fish. The effects of impingement and entrainment by the cooling systems of the two plants were also studied.

In January 1975 a plan was submitted to the Wisconsin Department of Natural Resources to study the environmental impact of the present water intake structure on the various species and life stages of fish, in compliance with the WPDES permit. Impingement and entrainment of fish was monitored and a report reflecting the best technology available for minimizing environmental impact was issued to the State DNR.

50 CFR Part 17.11 lists the Higgins' pearly eye mussel (*Lampsilis higginsi*) as an endangered species with a known distribution that includes the Mississippi River in Minnesota, Wisconsin, and Illinois. At the staff's request, the applicant has submitted a detailed plan for a survey of Thief Slough to determine whether Higgins' pearly eye mussels currently exist in locations where they could be affected by continued operation of the LACBWR. The staff has reviewed the applicant's program and finds it acceptable.

The staff concludes that these monitoring requirements are sufficient to document the aquatic environmental impacts of operating the LACBWR, as described in Section 5.

Although no surveys were made of the terrestrial plants and animals before construction, in the staff's opinion no surveys are warranted at this time because of the smallness of the plant and the lack of noticeable construction or operational impacts on the terrestrial ecology (Sec. 4.3.1 and 5.5.1).

6.4 RADIOLOGICAL

The operational offsite radiological monitoring program is conducted to measure radiation levels and radioactivity in plant environs. The program assists and provides backup support to the detailed effluent monitoring (as required by Regulatory Guide 1.21) which is needed to evaluate individual and population exposures and verify projected or anticipated radioactivity concentrations.

7. ENVIRONMENTAL IMPACT OF POSTULATED ACCIDENTS

7.1 PLANT ACCIDENTS

A high degree of protection against the occurrence of postulated accidents in the La Crosse Boiling Water Reactor is provided through correct design, manufacture, and operation, and the quality assurance program used to establish the necessary high integrity of the reactor system, as was considered in the Commission's Safety Evaluation. Deviations that may occur are handled by protective systems to place and hold the plant in a safe condition. Notwithstanding this, the conservative postulate is made that serious accidents might occur, even though they may be extremely unlikely; and engineered safety features are installed to mitigate the consequences of those postulated events which are judged credible.

The probability of occurrence of accidents and the spectrum of their consequences to be considered from an environmental effects standpoint have been analyzed using best estimates of probabilities and realistic fission product release and transport assumptions. For site evaluation in the Commission's safety review, extremely conservative assumptions are used for the purpose of comparing calculated doses resulting from a hypothetical release of fission products from the fuel against the 10 CFR Part 100 siting guidelines. Realistically computed doses that would be received by the population and environment from the accidents which are postulated would be significantly less than those presented in the Safety Evaluation.

The Commission issued guidance to applicants on September 1, 1971, requiring the consideration of a spectrum of accidents with assumptions as realistic as the state of knowledge permits. The applicant's response was contained in the "Environmental Report La Crosse Boiling Water Reactor," dated September 1972 and the "Environmental Report Supplement for La Crosse Boiling Water Reactor," dated June 15, 1973.

The applicant's report has been evaluated, using the standard accident assumptions and guidance issued as a proposed amendment to Appendix D, 10 CFR Part 50 by the Commission on December 1, 1971. Nine classes of postulated accidents and occurrences ranging in severity from trivial to very serious were identified by the Commission (Table 7.1-1). In general, accidents in the high potential consequence end of the spectrum have a low occurrence rate and those on the low potential consequence end have a higher occurrence rate. The examples selected by the applicant for these cases are shown in Table 7.1-1. The examples selected are reasonably homogeneous in terms of probability within each class.

Commission estimates of the dose which might be received by an assumed individual standing at the site boundary in the downwind direction, using the assumptions in the proposed Annex to Appendix D, are presented in Table 7.1-2. Estimates of the integrated exposure that might be delivered to the population within 50 miles of the site are also presented in Table 7.1-2. The man-rem estimate was based on the population within 50 miles of the site for the year 1970. The projected population to the year 2010 is expected to be essentially the same.

To rigorously establish a realistic annual risk, the calculated doses in Table 7.1-2 would have to be multiplied by estimated probabilities. The events in Classes 1 and 2 represent occurrences which are anticipated during plant operations; and their consequences, which are very small, are considered within the framework of routine effluents from the plant. Except for a limited amount of fuel failures the events in Classes 3 through 5 are not anticipated during plant operation; but events of this type could occur sometime during the 40-year plant lifetime. Accidents in Classes 6 and 7 and small accidents in Class 8 are of similar or lower probability than accidents in Classes 3 through 5 but are still possible. The probability of occurrence of large Class 8 accidents is very small. Therefore, when the consequences indicated in Table 7.1-2 are weighted by probabilities, the environmental risk is very low. The postulated occurrences in Class 9 involve sequences of successive failures more severe than those required to be considered in the design bases of protection systems and engineered safety features. Their consequences could be severe. However, the probability of their occurrence is judged so small that their environmental risk is extremely low. Defense in depth (multiple physical barriers), quality assurance for design, manufacture and operation, continued surveillance and testing, and conservative design are all applied to provide and maintain a high degree of assurance that potential accidents in this class are, and will remain, sufficiently small in probability that the environmental risk is extremely low.

Table 7.1-1. Classification of Postulated Accidents and Occurrences

Class	NRC Description	Applicant's Example
1.	Trivial incidents	Not evaluated
2.	Small releases outside containment	1 gpm equivalent steam leak in turbine building
3.	Radioactive waste system failure	Iodine desorption; 25% of liquid and gaseous radwaste storage tank contents released. 100% release of gases from 1600 ft^3 tank.
4.	Fission products to primary system (BWR)	Off design transients
5.	Fission product to primary and secondary systems (PWR)	Not applicable
6.	Refueling accident	Fuel bundle drop; heavy object drop onto fuel in core.
7.	Spent fuel handling accident	Cask drop; heavy object drop onto fuel rack.
8.	Accident initiation events considered in design-basis evaluation in the Safety Analysis Report	Various size primary pipe ruptures; steam line break; control rod drop.
9.	Hypothetical sequence of failures	Not considered: Under Rulemaking[4]

The NRC has performed a study to assess these risks more quantitatively. The initial results of these efforts were made available for comment in draft form on August 20, 1974,[1] and released in final form on October 30, 1975.[2] This study, called the Reactor Safety Study, was an effort to develop realistic data on the probabilities and consequences of accidents in water-cooled power reactors in order to improve the quantification of available knowledge related to nuclear reactor accident probabilities. The Commission organized a group of about 50 specialists under the direction of Professor Norman Rasmussen of MIT to conduct the study. The scope of the study has been discussed with the EPA and described in correspondence with the EPA, which has been placed in the NRC Public Document Room (letter, Doub to Dominick, dated June 5, 1973).

In July 1977, the NRC organized the independent Risk Assessment Review Group to (1) clarify the achievements and limitations of the Reactor Safety Study (RSS), (2) assess the peer comments thereon and the responses to the comments, (3) study the current state of such risk assessment methodology, and (4) recommend to the Commission how and whether such methodology can be used in the regulatory and licensing process. The results of this study were issued September 1978.[3] This report, called the Lewis Report, contains several findings and recommendations concerning the RSS. Some of the more significant findings are summarized below.

1. A number of sources of both conservatism and nonconservatism in the probability calculations in RSS were found, which were very difficult to balance. The Review Group was unable to determine whether the overall probability of a core-melt given in the RSS was high or low, but they did conclude that the error bands were understated.

2. The methodology, which was an important advance over earlier methodologies that had been applied to reactor risk, was sound.

3. It is very difficult to follow the detailed thread of calculations through the RSS. In particular, the Executive Summary is a poor description of the contents of the report, should not be used as such, and has lent itself to misuse in the discussion of reactor risk.

On January 19, 1979, the Commission issued a statement of policy concerning the RSS and the Review Group Report. The Commission accepted the findings of the Review Group.

Table 7.1-2 indicates that the realistically estimated radiological consequences of the postulated accidents would result in exposures of an assumed individual at the site boundary which are less than or comparable to those which would result from a year's exposure to the Maximum Permissible Concentrations (MPC) of 10 CFR Part 20. The table also shows the estimated integrated exposure of the population within 50 miles of the plant from each postulated accident. Any of these integrated exposures would be much smaller than that from naturally occurring

radioactivity. When considered with the probability of occurrence, the annual potential radiation exposure of the population from all the postulated accidents is an even smaller fraction of the exposure from natural background radiation and, in fact, is well within naturally occurring variations in the natural background. It is concluded from the results of the realistic analysis that the environmental risks due to postulated radiological accidents are exceedingly small and need not be considered further.

Table 7.1-2. Summary of Radiological Consequences of Postulated Accidents[1/]

Class	Event	Estimated Fraction of 10 CFR Part 20 limit at site boundary[2/]	Estimated Dose to Population in 50-mile radius (man-rem)
1.0	Trivial Incidents	3/	3/
2.0	Small releases outside containment	3/	3/
3.0	Radwaste System failures		
3.1	Equipment leakage or malfunction	0.33	1.5
3.2	Release of liquid waste storage contents	0.001	<0.1
4.0	Fission products to primary system (BWR)		
4.1	Fuel cladding defects	3/	3/
4.2	Off-design transients that induce fuel failures above those expected	0.014	0.15
5.0	Fission products to primary and secondary systems (PWR)	N.A.	N.A.
6.0	Refueling accidents		
6.1	Fuel bundle drop	0.001	<0.1
6.2	Heavy object drop onto fuel in core	0.01	<0.1
7.0	Spent fuel handling accident		
7.1	Fuel assembly drop in fuel rack	0.002	<0.1
7.2	Heavy object drop onto fuel rack	0.003	<0.1
7.3	Fuel cask drop	0.027	0.12
8.0	Accident initiation events considered in design basis evaluation in the SAR		
8.1	Loss-of-Coolant Accidents		
	Small Break	0.027	0.23
	Large Break	0.11	3.8
8.1(a)	Break in instrument line from primary system that penetrates the containment	<0.001	<0.1
8.2(a)	Rod ejection accident (PWR)	N.A.	N.A.
8.2(b)	Rod drop accident (BWR)	<0.001	<0.1
8.3(a)	Steamline breaks (PWR's outside containment)	N.A.	N.A.
8.3(b)	Steamline break (BWR)		
	Small Break	0.012	<0.1
	Large Break	0.059	<0.1

1/ The doses calculated as consequences of the postulated accidents are based on airborne transport of radioactive materials resulting in both a direct and an inhalation dose. Our evaluation of the accident doses assumes that the applicant's environmental monitoring program and appropriate additional monitoring (which could be initiated subsequent to a liquid release incident detected by in-plant monitoring) would detect the presence of radioactivity in the environment in a timely manner such that remedial action could be taken if necessary to limit exposure from other potential pathways to man.

2/ Represents the calculated fraction of a whole body dose of 500 mrem, or the equivalent dose to an organ.

3/ These releases are expected to be a small fraction of 10 CFR Part 20 limits for either gaseous or liquid effluents.

Experience with real accidents at nuclear power plants has also been considered in this assessment of their environmental risk at La Crosse. The accident at the Three Mile Island-Unit 2 facility (TMI-2) on March 28, 1979, was found to have resulted in an estimated dose to the population living within a 50-mile radius of the plant of approximately 2000 man-rem ("Report of the President's Commission on the Accident at Three Mile Island." October 1979). An accident at the La Crosse facility in which the same fractions of the reactor core inventory of radioactive fission products would be released to the atmosphere would be estimated to result in a population dose approximately 100 times smaller, since the total inventory of radionuclides at LACBWR is a small percentage (±5%) of that at TMI-2. This stems from the fact that the population living within 50 miles of the La Crosse facility is about six times smaller than that

surrounding Three Mile Island, and the fact that the power level of the La Crosse facility is about 18 times smaller than that of TMI-2. Further, even though the La Crosse reactor, a boiling water reactor, is very different from the TMI-2 pressurized water reactor, and does not contain a pressurizer or a power operated relief valve, both of which were important parts of the TMI-2 accident, the NRC has taken steps to improve the safety of operation of the La Crosse reactor as a result of lessons learned in the TMI-2 accident. These additional requirements are judged to further reduce the likelihood of occurrence of a serious degraded core cooling event and, pursuant to a Show Cause Order issued on January 2, 1980, must be implemented on or before June 1, 1980. For these reasons, it is concluded that the environmental risk of accidents at the La Crosse facility is exceedingly small.

7.2 TRANSPORTATION ACCIDENTS

The transportation of cold (unirradiated) fuel to the plant, of irradiated fuel from the reactor to a fuel-reprocessing plant, and of solid radioactive wastes from the reactor to burial grounds is within the scope of an AEC (now NRC) report.[4] Table 7.2-1 summarized the environmental risks of accidents during transportation.[4]

Table 7.2-1. Environmental Risks of Accidents in Transport of Fuel and Waste to and from a Typical Light-Water-Cooled Nuclear Power Reactor[a]

	Environmental risk
Radiological effects	Small[b]
Common (nonradiological) causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year.

[a]Data supporting this table are given in the Commission's Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238, December 1972.

[b]Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multireactor site.

References

1. "Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," WASH-1400, Draft, August 1974.

2. Reactor Safety Study; An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," WASH-1400, NUREG 75/014, October 1975.

3. "Risk Assessment Review Group Report, NUREG/CR-0400, September 1978.

4. Public Service Co. of Oklahoma (Black Fox Station, Units 1 and 2) CLI-80-8, March 21, 1980

5. U.S. Atomic Energy Commission, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," WASH-1238, December 1972.

*Section 8.1: Add: On March 26, 1982 the Commission amended its regulations in 10 CFR Part 51 (47 FR 12940) to eliminate consideration of need for power and alternative energy sources in operating license proceedings for nuclear power plants. See: 10 CFR §51.23(e), as revised.

8. ALTERNATIVES TO CONTINUED OPERATION OF LACBWR

In this section, the staff addresses the economic and reliability consequences associated with the decision on a full-term operating license (FTOL) for LACBWR. The analysis adopts the finding of the ASLB of the need for power and continued operation of LACBWR for a three year period extending into 1983. Dairyland Power Cooperative (LaCrosse Boiling Water Reactor) LBP-80-2, Initial Decision, January 10, 1980.)

8.1 ALTERNATIVE TO THE CONTINUED OPERATION OF LACBWR

The consequence of denying a full-term operating license (FTOL) for LACBWR is to begin decommissioning the facility. The following analysis considers what alternatives might be available to the applicant and compares these to the continued operation of LACBWR.*

8.1.1 System Operation and Economic Effects

Two reasonable alternatives were compared to LACBWR. These are: (1) to purchase power and capacity and (2) to build a combustion turbine (CT) fired with fuel oil. Since the service area is small, no consideration was given to building a large facility which could provide low-cost power per kWh, because this would not be feasible unless undertaken as a joint project with a large utility. The analysis was done covering a 20-year period, because this is the approximate expected remaining life for LACBWR (which began operation in 1967).

Table 8.1-1 shows the results of this comparison based on 1980 present value. The assumptions used to derive these data are:

3% real discount rate (NUREG-0607);

O&M costs increase the same as general inflation;

coal costs (the applicant's principal fuel)escalates 3% faster/yr than general inflation;

nuclear fuel costs escalate 3% faster/yr than general inflation;

residual fuel oil prices increase 5% faster than general inflation;

LACBWR will be mothballed when decommissioned because it is on a dedicated site;

2/3 of the fuel in the reactor will be unused (lost) if LACBWR is decommissioned;

if LACBWR is decommissioned, the fuel is stored at the site for 20 years;

LACBWR and purchased power and capacity (demand charge) costs are derived from applicant responses;

CT costs are from "Technical Assessment Guide," EPRI PS-1201-SR, July 1979, Electric Power Research Institute; and

if a CT is selected, it would provide 5% of the power which would have come from LACBWR, the remainder from higher use of other plants on the DPC system.

Decommissioning costs are based on those for a 1000 MW plant. Costs for LACBWR would be significantly less.

FIGURE 8.1-1

JULY 1, 1979 SERVICE AREA DAIRYLAND POWER COOPERATIVE LA CROSSE, WISCONSIN

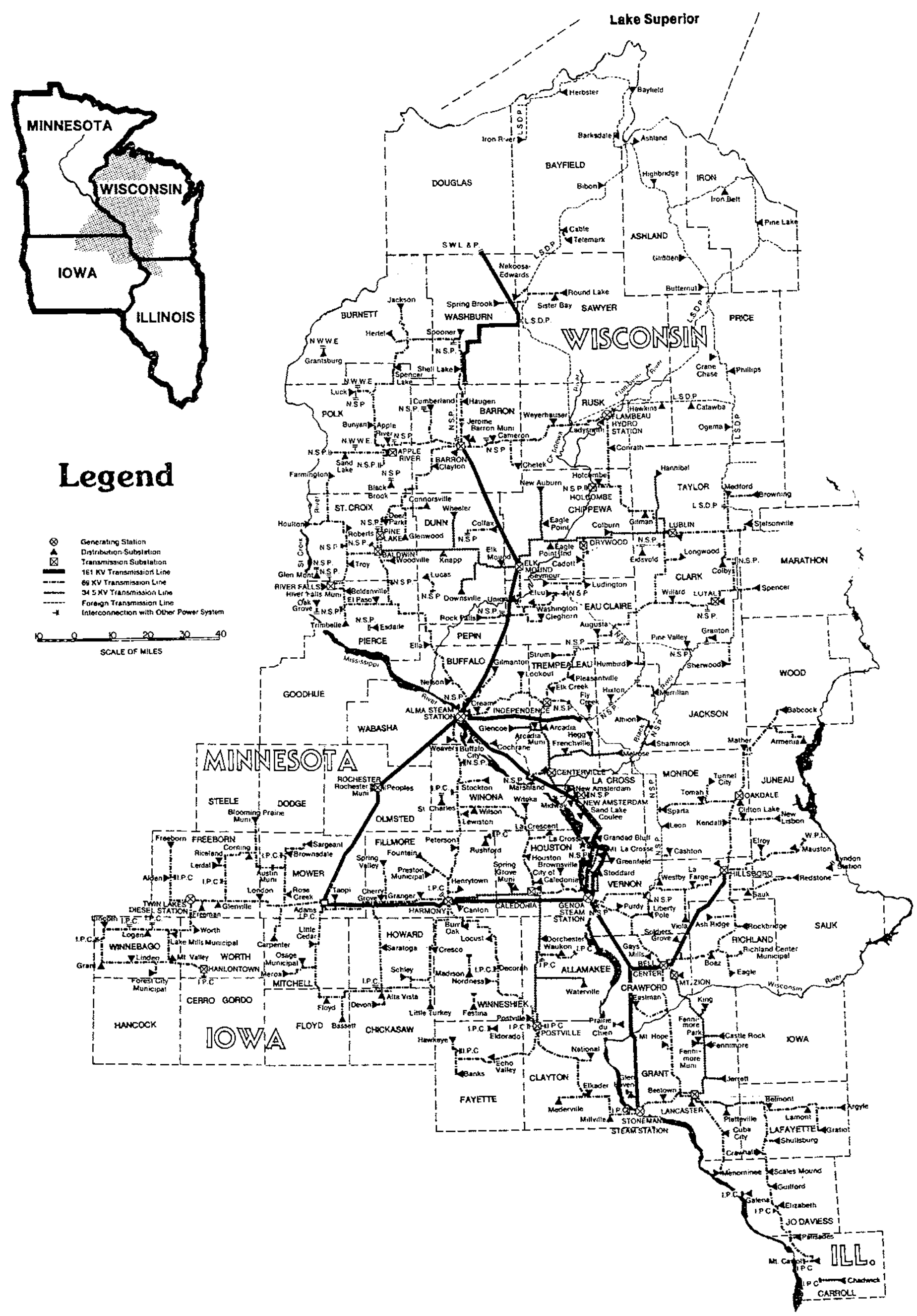

Table 8.1-1. Costs of Alternatives to La Crosse FTOL at 40% and 50% Capacity Factors, 20-Year Present Value (millions of 1980 dollars)

	La Crosse FTOL		Decommission La Crosse, Purchase Capacity and Power		Decommission La Crosse, Build oil-fired CT	
Costs	40%	50%	40%	50%	40%	50%
Capital (present value of annual fixed charge rate)	0	0	20.7	20.7	37.5	37.5
Fuel	24.2	30.2	90.3[a] 58.8[b,c]	112.8[a] 73.5[b]	112.9	123.7
O&M	38.7	38.7				
Loss of nuclear fuel in core	0	0	3.0	3.0	3.0	3.0
Spent fuel storage	0	0	0.1	0.1	0.1	0.1
Decommission La Crosse	8.8	8.8	11.8	11.8	11.8	11.8
Total cost[a]	71.7	77.7	125.9	148.4		
Total cost[b]			94.4	109.1	165.3	176.1
Total cost[a,d]			105.2	127.7		
Total cost[b,d]			73.7	88.4		

[a]The cost of replacement power if DPC purchases the power.

[b]The cost of replacement power if existing units on the system are run at a higher capacity factor to replace LACBWR.

[c]80% of fixed O&M costs are charged to replacement of LACBWR.

[d]Cost if capacity purchase cost not charged to LACBWR decommissioning.

The analysis was done for 40% and 50% capacity factors. Although the plant productivity has significantly improved in the most recent cycle since the fuel problems causing extensive shutdown have been solved. The cost of assuring the availability of capacity, called demand charge, was included as the base case. However, it is not clear that, given the past record of reliability of LACBWR, the demand charge could be increased following decommissioning. Thus, the cost without the demand charge is also shown. In all cases it is found that continued operation of LACBWR provides the lowest cost alternative. The closest case is for 40% capacity factor with a total cost of $71.7 million, compared to $73.7 million if LACBWR is decommissioned and other plants on the system provide the needed power. In this case the cost difference is about 3%, but it should be remembered that decommissioning costs would be considerably less than costs used as basis. If it is correct to include the demand charge, or if 50% capacity factor is a better future performance expectation for LACBWR, then rather significant cost penalties would result from the decision to not grant the FTOL. Additional factors to be considered are the benefit of excess capacity in the system for use as emergency power or fossil fuel displacement and the fact that peaking power purchase costs are considerably higher than economy or replacement power costs.

8.2 Need for Facility Based on Reliability

8.2.1 General Description

Dairyland Power Cooperative (DPC--the applicant) is a wholesale producer and seller of power, with no retail customers. The applicant's primary sales are to 29 distribution cooperatives in Wisconsin (21), Iowa (4), Minnesota (3), and Illinois (1). These cooperatives are the owners of Dairyland Power Cooperative. The locations and service areas of the cooperatives are shown in Figure 8.2-1. The distribution cooperative franchise areas are almost entirely rural. About 83% of the power sold is to farms and rural homes, with about 10% purchased by governmental bodies and about 5% by commercial and industrial enterprises. In contrast, nationally about 40% of power consumption is industrial, 23% commercial, 32% residential, and 5% miscellaneous.[1]

The applicant also sells power under long-term contract to the Cooperative Power Association, a group of 17 distribution cooperatives in central Minnesota. Sales to, and purchases from, neighboring investor-owned utilities also occur under shorter-term agreements based on mutual convenience and economy.

8.2.2 Applicant's Power System

The applicant's current winter generating capability is about 1043 MWe. The capacity is provided by five separate generating stations and is almost totally coal fired. The non-coal exceptions consist of approximately 21 MWe of oil-fired peaking and reserve capacity, 16 MWe of hydro, and the 46 MWe of baseload capacity represented by LACBWR. A listing of DPC's current generating units appears in Table 8.2.1

Because of the geographic diffuseness of its load, the applicant has an extensive transmission system of about 3000 miles. Because of the proximity of LACBWR to the larger Genoa 3, only 1000 feet of 69-kV line was constructed to incorporate LACBWR into the system.

8.2.3 Regional Relationships

The applicant is a member of the Mid-Continent Area Power Pool (MAPP), an organization of 35 generation and transmission cooperatives, investor-owned companies, and public power districts for the purpose of joint planning of bulk generating and transmission facilities and for the interchange of wholesale power to increase reliability and reduce costs. Because the franchise areas are extensively interlaced, with investor-owned companies generally serving the cities and larger towns while the cooperatives serve much of the rural area, power exchanges are particularly valuable in minimizing transmission losses.

MAPP also is intended to coordinate the planning and construction of large generating and transmission facilities throughout the north-central region, and to coordinate interpool power exchanges and sales.

Table 8.2-1. Dairyland Power Cooperative Generating Units[a]

Facility	Winter Capacity, MWe	Mode of Operation	Fuel
Alma Unit No. 1	20.2	Cycling	Coal
Alma Unit No. 2	20.7	Cycling	Coal
Alma Unit No. 3	20.9	Cycling	Coal
Alma Unit No. 4	59.4	Baseload	Coal
Alma Unit No. 5	85.8	Baseload	Coal
Alma Unit No. 6	350.-[b]	Cycling	Coal
E.J. Stoneman Unit No. 1	19	Cycling	Coal
E.J. Stoneman Unit No. 2	33	Cycling	Coal
Genoa No. 1	12.6	Reserve	Oil
Genoa No. 2 (LACBWR)	46.	Baseload	Nuclear
Genoa No. 3	350.3[c]	Baseload	Coal
Flambeau	16.	Cycling	Hydroelectric
Twin Lakes	8.7	Peaking	Oil

[a]From letter from T.A. Steele, DPC, to R.L. Ballard, USNRC, December 12, 1979.
[b]260 MW is contracted to Northern States Power Company.
[c]175 MW is contracted to Cooperative Power Assoc.
(From Hearing Transcript, Docket 50-409, October, 1979, pp. 790 and 813)

8.2.4 HISTORICAL DEMAND

8.2.4.1 Peak Power Demand

The annual peak power demand on the applicant's system from member cooperatives occurs in the winter. Between 1967 and 1978, this native annual peak demand has grown at an average annual compound rate of about 6.1%. Between the limited period of 1974 and 1978 annual growth averaged about 7%, although it is over this period that energy conservation and public recognition of a serious energy problem caused a decline in energy growth, nationally. However, growth over this latter period has been extremely erratic with, for example, peak demand growing at 11.6% in 1976 and 1.1% in 1977.

8.2.4.2 Energy Consumption

From 1967 to 1978 the annual consumption of electric energy in the applicant's system has grown at an average annual rate of about 7%, with slightly slower growth between 1974 and 1978 of about 6.7%. Although growth in this most recent period has declined, the 6.7% DPC rate contrasts sharply with a growth rate for the nation as a whole of about 3.1%. Thus, overall it appears that growth factors inherent to the applicant's system have remained strong relative to the experience at the national level.

On balance, the historic DPC growths in energy and in peak demand have increased in similar ways. This implies that load characteristics have remained relatively constant over this time period, with a system load factor of about 55% (the system load factor is the ratio of the average load supplied during a designated period to the peak load occurring in the same period).

8.2.5 PROJECTED ENERGY AND PEAK DEMAND

8.2.5.1 Applicant's Projections

The applicant's latest projections for the 1980 to 1990 period for winter peak demand and energy requirements are presented in Table 8.2.5.1.The applicant's peak load forecast translates into an annual compound growth rate between 1978 and 1985 of 6.7% with growth slowing to 4.8% between 1985 and 1990. For annual energy requirements, the corresponding growth rates are 5.9% between 1978 and 1985, and 5.4% between 1985 and 1990. The applicant's projections appear on the high side relative to what is being forecast by other utilities throughout the country. However, the staff notes that the DPC service area is atypical because of its unusually heavy dependence on farm related activity, and growth in demand on the applicant's system has far exceeded the national average since the oil embargo in late 1973.

Table 8.2.5.1 Dairyland Power Cooperative Forecasted Peak Demand and Energy Requirements, 1980-1990[a]

	Winter Peak Demand, MW	Annual Energy Requirements, GWh
1980	696	3276
1981	754	3471
1982	793	3684
1983	831	3875
1984	872	4067
1985	913	4284
1986	955	4517
1987	1001	4767
1988	1048	5023
1989	1099	5253
1990	1153	5561

[a]Source: DPC response to USNRC, Environmental Projects Branch 1, of December 14, 1979, exhibit (WLB2).

8.2.5.2 Staff's Projections

The staff's forecast of demand for electrical energy is based on a regional econometric forecasting model developed by the Oak Ridge National Laboratory (ORNL).[2] The ORNL model, which forecasts electricity demand and price through 1990, uses a system of simultaneous equations and contains submodels for residential, commercial, and industrial sectors. Structural parameters were estimated for the nine census regions of the United States, using State level data for 1955 through 1974.

Electricity demand and price are forecast for each state by inputting economic and demographic variables to the model. Assumptions of growth in population, residential customers, and real per capital income are based on projections by the National Planning Association. Growth of value added in manufacturing is based on projections made by the Federal Energy Administration while projections of commercial and industrial customers are based on extrapolation of historical trends. Assumptions on future fuel prices were varied to capture the uncertainty inherent in forecasting future demand for power. The base case assumptions of future fuel prices are derived from the Hudson and Jorgenson projections of fuel prices.[3] The model also considers forecasts of electrical energy demand resulting form higher and lower fuel costs relative to those assumed in the ORNL base case projections. In the low price case, it is assumed that energy prices will increase at the same rate as the cost of living index, and in the high price case, all price and cost components relative to the base case are assumed to double in real terms. The staff no longer assesses effects of rate structure, advertising, etc., as energy conservation measures since the rapidly escalating prices of all fuels has resulted in significant rate increases by all utilities and is considered to be the most effective and presently operative method of energy conservation.

Not only does the applicant's service extend into several states, but the portions included are not representative of their states because they by-pass all the major urban c ters of the region. Recognizing these discrepancies, the staff has approximated growth in the DPC service area as being equal to ORNL growth projections for the State of Wisconsin. This choice reflects the fact that presently Wisconsin's share of DPC's energy requirements is about 65% and this share is expected to rise to 70% by 1990. The ORNL model is not designed to capture the primarily rural composition of the DPC service area relative to the State of Wisconsin, and is recognized as an inherent limitation in this forecasting approach.

The staff's forecast for the DPC service area results in annual compound growth rates in electrical energy requirements between 1978-1985 of between 3.9% and 5.8%, with a most likely growth rate of 4.85% using base case assumptions. Between 1985 and 1990 the staff projections range from 2.6% to 5.0% with a base case forecast of 3.75%. The applicant's own forecast (5.9% -- 1978-85, and 5.4% -- 1985-90) conforms well with the high end (low price scenario) of the staff's estimates (5.83% -- 1978-85, and 5.00% -- 1985-90) Given the uncertainties in load forecasting, the staff does not consider the difference between the applicant's and the staff's forecasts as significant.

The applicant assumes that between 1978-85, peak load demand will grow considerably faster than energy requirements (6.7% vs. 5.9%). Alternatively, the staff assumes that an absolute differential of plus 0.3% will be maintained throughout the forecast period. This is consistent with the most recent historical experience, 1974-78, and also conforms well with the differential expected by the applicant over the entire forecast period, 1978-90. However, on balance, the staff's assumption on peak load growth results in lower estimates during the intervening years than those that would occur had the staff adopted the applicant's assumption of a varying differential.

8.2.6 RELIABILITY ASSESSMENT

Table 8.2.6 presents the staff's and the applicant's reliability analyses. Contrasting the staff's peak load forecasts with DPC's latest planned capability shows that, based solely on reliability, LACBWR will be needed in order to maintain the minimum reserve margin criterion, from one to five years later than the applicant's own analysis indicates. The difference can be attributed totally to the staff's lower forecasts of peak demand. This assessment assumes that a minimum reserve margin of 15% is necessary to maintain reliable service on the DPC system.

Table 8.2-6. DPC Winter Peak, Capacity, and Reserve Margins, 1980-81 through 1990-91

Winter	Peak Demand[a]				Total Capability (MWe)[b] without LACBWR	Reserve Margin as % of Peak Demand (without LACBWR)	Staff		
	Applicant[c]	High Price Scenario	Staff Base Case Scenario	Low Price Scenario		Applicant[c]	High Price Scenario	Base Case Scenario	Low Price Scenario
1980-81	700	634	645	657	827	18.1	30.4	28.2	25.9
1981-82	758	660	678	697	827	9.1	25.3	22.0	18.7
1982-83	797	687	713	740	827	3.8	20.4	16.0	11.8
1983-84	835	716	749	785	902	8.0	26.0	20.4	14.9
1984-85	876	746	788	833	902	3.0	20.9	14.5	8.3
1985-86	917	777	828	884	902	-1.6	16.1	8.9	2.0
1986-87	959	799	862	930	902	-5.9	12.9	4.6	-3.0

[a]All peak load forecasts include 4 MW of firm sales.

[b]For the winter of 1980-81 to 1982-83 Total Capability equals system capability of 997 WM (Note: excludes LACBWR--46 MW) less participation sale of 170 MW. For the winter of 1983-84 to 1986-87 Total Capability equals system capability of 997 MW plus participation purchase of 75 MW less participation sale of 170 MW.

[c]Adapted from letter from T.A. Steele, DPC, to R. Geckler, USNRC, December 14, 1979.

The staff concludes that from a reliability perspective, LACBWR will be needed sometime in the mid-1980s. Such need could occur as early as the winter of 1982-83 if the high end of the staff's forecast range were realized, or as late as the winter of 1986-87 if growth corresponds to the low end of our forecast range. The most probable time of inadequate reserves commences in the winter of 1984-85 which corresponds to our base case forecast. In all cases, once the initial need arises, it is expected to continue over the useful life of LACBWR. On the surface, it appears that if additional capacity is added in the future, DPC's projected reserve margins may prove adequate without LACBWR, and in fact a scheduled addition presently planned for the winter of 1987-88 of 520 MWe could accomplish just that. However, in the staff's opinion, the need for existing capacity such as LACBWR should not be influenced by future additions. Clearly, having the 46 MWe of LACBWR online can only delay or reduce the size of future expansions. The options of delay or reduced size must be viewed as preferable to an earlier and/or larger commitment to capital outlays on the DPC system and their construction impacts in the socioeconomic and environmental areas.

8.3 CONCLUSION

Based on the evaluation in this section, the staff concludes that if the units' capacity factor approximates 40%, there will be no cost penalty associated with its continued long-term operation; whereas, if the capacity factor approximates 50%, significant economic savings should be realized. Futhermore, the ASLB has already ruled that a need for LACBWR exists in the near-term future (1980-82); and based on staff reliability analysis, will be needed to maintain reserves sometime in the 1982-86 timeframe.

References

1. "The 1970 National Power Survey," Federal Power Commission, Washington, DC, Part III, p. III-2-69.
2. "Regional Econometric Model for Forecasting Electricity Demand by Sector and by State," Oak Ridge National Laboratory, NUREG/CR-0250, October 1978.
3. E.A. Hudson and D.W. Jorgenson, "U.S. Energy Policy and Economic Growth, 1975-2000," Bell Journal of Economics and Management Science, 5:461-514 (Autumn 1974).

9. PLANT DESIGN ALTERNATIVES

9.1. Cooling System Alternatives

Modern thermal electric generating plants (fossil-fueled or nuclear) discharge to the waste heat dissipation system from 5100 to 7000 Btu of waste heat for each kWh of electrical energy generated. The higher figure is typical of current nuclear plants and LACBWR.

Of the established methods of large-scale cooling, the more widely used ones involve either (a) the transfer of heat (and water vapor) to the atmosphere by direct evaporation of water in "wet" cooling towers, spray ponds, or canals or (b) discharge of heat to a body of water. Even in the latter case, the heat is eventually transferred to the atmosphere, chiefly by evaporation, although radiation and convection play some part. Heat may also be transferred directly to the atmosphere, as in automobile radiators, by "dry" cooling towers.

The direct-evaporation methods are commonly used in "closed-cycle" systems in which most of the cooled water is recirculated. Additional water must be provided to make up for that evaporated (about 0.6 gallons per kWh generated for a current nuclear plant). Since the original dissolved-salt content of the water evaporated is left in the system, the salt concentration in the recirculated water would rise continuously were not additional makeup water provided and a "blowdown" flow discharged from the system. Even if no dissolved salts were introduced in the plant, the concentration in the blowdown would be increased by a factor proportional to the ratio of the makeup to "blowdown" flow rates.

In "once-through" or "open-cycle" cooling, all of the circulating cooling water is taken from a lake or stream and returned at a higher temperature to a point sufficiently remote from the intake so that little or no recirculation occurs. Except when the discharge stream is evaporatively cooled--such systems exist but are rare--no evaporation occurs within the plant, but about 0.5 gallon per kWh generated is eventually evaporated by the body of water with a corresponding increase in the concentration of dissolved salts (usually very small). With either open- or closed-cycle systems it is usual for (relatively innocuous) chemical additions within the plant to increase the total salt content of the discharge appreciably.

In the following sections the closed-cycle systems considered are dry cooling towers, natural-draft wet cooling towers, mechanical-draft wet cooling towers, wet/dry cooling towers, cooling lake, spray canal, and auxiliary cooling of a once-through system. These are evaluated against the existing once-through cooling system now in use. The staff concludes that, on balance, none of the alternative cooling systems would be superior to the existing system, which has been judged acceptable.

9.1.1. Dry Cooling Towers

Dry cooling towers remove heat from a circulating fluid through radiation and convection to air being circulated past the heat exchanger tubes. Because of the poor heat-transfer properties of air, tubes are generally finned to increase the heat-transfer area. The theoretical lowest temperature that a dry cooling system can achieve is the dry-bulb temperature of the air. The dry-bulb temperature is always higher than the wet-bulb temperature, which is the theoretical lowest temperature that a wet cooling tower can achieve. As a result, dry cooling towers are a less efficient cooling system, which leads to increased cost and size of the cooling equipment.

The advantage of a dry cooling tower system is its ability to function without large quantities of cooling water. In theory, this allows power plant siting without consideration of limited water availability, and eliminates thermal/chemical pollution of the aquasphere. From an environmental and cost-benefit standpoint, dry cooling towers can permit optimum siting with respect to environmental, safety, and load distribution criteria without primary dependence on a supply of cooling water. When considered as a direct alternative to wet cooling towers, the advantages of dry cooling towers include elimination of drift problems, fogging and icing, and blowdown disposal.

The principal disadvantage of dry cooling towers is economic: for a given reactor size, plant capacity can be expected to decrease by about 5% to 15% depending on ambient temperatures and assuming an optimized turbine design. Bus-bar energy costs are expected to be on the order of 20% more than for a once-through system, and 15% more than for a wet cooling tower system, in terms of 1980 operation.[1] Environmentally, the effects of heat releases from dry cooling towers have not yet been quantified; some air pollution problems may be encountered; noise generation problems for mechanical-draft dry towers will be equivalent or more severe than those of wet cooling towers; and the esthetic impact of natural-draft dry towers, despite the probable absence of a visible plume, will remain.

On balance, dry cooling towers are an attractive alternative whenever the costs (economic and environmental) of water for evaporative cooling are sufficiently high. If no substantial environmental costs were involved, the break-even delivered price of water would be in the range of \$2 to \$4 per thousand gallons, considerably higher than the cost of domestic water in most parts of the U.S. In view of this, a dry cooling tower is not considered a reasonable choice.

9.1.2 Natural-Draft Wet Cooling Towers

In this type of tower air moves upward as a result of the chimney effect (natural draft) created by the difference in density between the warm moist air inside the tower and the colder, denser air outside. Natural-draft towers have been chosen for many recently designed generating stations because they do not give rise to the ground-level fogging and icing which are sometimes troublesome with spray cooling or mechanical-draft wet tower systems. The natural-draft tower is also comparatively readily maintained and is quiet in operation.

The primary disadvantage is the great size required for effective units. A tower for a 50-MWe nuclear unit would be about 200 feet high.

9.1.3 Mechanical-Draft Wet Cooling Towers

In mechanical-draft towers the air movement needed to produce the required evaporation from the cooling water stream is generated by motor-driven fans. Tower height is much less than in the natural-draft case and construction costs are less. The lower construction cost is largely offset by the cost of fan power and maintenance so that the overall life-of-plant cost is much the same for natural-draft and mechanical-draft tower closed-cycle systems.

Because of the smaller tower height, the probability of induced localized fogging and icing near mechanical-draft towers is markedly greater than for natural-draft towers.

The smaller towers are less conspicuous than natural-draft towers. On the other hand, they are much noisier, generating mildly irritating noise levels as far away as three to four thousand feet.

9.1.4 Wet/Dry Cooling Towers

As noted above, wet towers can cool to lower temperature than is achievable with dry towers while dry towers consume no water by evaporation. Combination designs exist in which the circulating coolant is partly cooled by a dry tower before passing through a wet tower, thereby reducing evaporative loss of water (at the expense of higher capital cost). With the amount of water available from the river, the expense cannot be justified.

9.1.5 Cooling Lake

The cooling lake is a simple and easily maintained system (assuming favorable soil conditions, etc.) with little susceptibility to storm or tornado damage. Because of the great heat capacity of the impounded water, system performance suffers very little in the short term from extremely hot weather. Similarly, the lake system is tolerant of large temporary overloads. The chief disadvantage is the large land area which must be committed to the lake, typically from one to three acres per MWe plant rating. The cost of construction is sensitive to topography as well as to land cost. Construction impact would be significant.

9.1.6 Spray Canal

In contrast with cooling towers and ponds, which have been used for decades, there has been little operating experience with large spray cooling systems, especially in winter, the season of greatest interest. Experience at a power plant with a spray cooling canal in northern Illinois indicated no serious environmental or fogging problem after two seasons of operation.[2-4]

Experience with spray canals in Michigan[5] and New Hampshire[4] are similar. As with cooling ponds, the fogging and icing effects decrease with distance; the Michigan study indicates that a distance of 600 feet from the canal to public roads and switchyards is sufficient to preclude any hazardous conditions arising from the drifting spray. The situation at LACBWR appears marginal. From the limited experience to date, it is reasonable to expect that spray cooling systems will create more severe icing conditions near the spray canal during winter than mechanical-draft cooling towers and quiescent cooling ponds, with drift being the primary cause of the difference.

The spray canal is inconspicuous as compared to natural-draft towers and quiet as compared to mechanical-draft towers.

9.1.7 Auxiliary Cooling of a Once-Through System

The heated condenser discharge stream may be partly cooled by cooling towers or in a spray canal before being returned to a cooling lake or other receiving body, thereby reducing the thermal impact on the receiving waters.

9.1.8 Economic Considerations

The staff estimates the cost of any of the "wet" alternatives as about $25,000 per MWe for large (1000-MWe) nuclear plants. Wet/dry tower combinations would cost two to three times as much and dry towers would cost five to six times as much. Land availability would probably exclude a cooling lake or canal at the LACBWR site, while a wet natural-draft tower would be overly expensive for a 50-MWe plant (the minimum tower height is about 200 feet, regardless of cooling capacity, in order to secure draft). However, a wet natural-draft tower cooling both Genoa 3 and LACBWR would be feasible, but not justified on environmental grounds.

9.1.9 Evaluation of Cooling System Alternatives

This evaluation appears to the staff to rest on the following considerations:

1. No specific ecological damage is known to have resulted from the continued once-through cooling of LACBWR.

2. LACBWR contributes only 20% of the heat and none of the chlorine to the combined discharge (with Genoa 3).

3. Land availability restricts the practicable alternative means of cooling to either mechanical-draft or natural-draft wet cooling towers, the much higher cost of dry or wet/dry towers being unwarranted in view of the ample available water supply.

4. A natural-draft tower would be uneconomic for LACBWR alone because of the small size of the plant. The proximity of the site to a railroad and a major state highway makes the probable occasional fog induction by mechanical-draft towers of substantial concern.

The staff believes that the reduced impact on aquatic life which would result from closed-cycle cooling of LACBWR would be, at most, only marginally perceptible. This sole benefit is overbalanced, in the staff's opinion, by the substantial economic cost (a very rough estimate is $1.5 million, or about $12 for each consumer member served by the applicant) of closed cycle cooling, as well as by the public nuisance and hazard which would result from the occasional induction of fog.

9.1.10 Other Plant Design Alternatives

The staff has considered alternative designs with respect to cooling-water intake and discharge structures, sanitary sewer system, and radwaste systems. In these categories, the present environmental effects are modest, at worst, and would not be reduced materially by any available alternative. Cost of any of the alternatives appears to be unjustifiable in terms of the environmental and economic costs.

9.2 ALTERNATE SOURCES

In view of the fact that LACBWR is an operating plant and its output is being utilized by the applicant at the present time, consideration of alternative sources of power (e.g., solar, geothermal, wind, etc.) does not appear warranted because they are not immediately available. Also, the relevant costs for LACBWR are for operation and maintenance and fuel, but not capital costs which are sunk and cannot be recovered.

References

1. K.A. Oleson et al., "Dry Cooling for Large Nuclear Power Plants," Westinghouse Electric Corp. Power Generation Systems, Report Gen-72-004, February 1972.

2. "Final Environmental Statement Related to the Dresden Nuclear Power Station," U.S. Atomic Energy Commission, 1973.

3. "Reviewing Environmental Impact Statements--Thermal Power Plant Cooling Water Systems," USEPA, National Thermal Pollution Research Program, Corvallis, Oregon, 1973.

4. J.E. Carson, "The Atmospheric Consequences of Thermal Discharges from Power Generating Stations," Annual Report, Radiological Physics Division, Argonne National Laboratory, 1971.

5. D.P. Hoffman, "Spray Cooling for Power Plants," American Power Conference, Chicago, May 1973.

10. EVALUATION OF THE PROPOSED ACTION

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

10.1.1 Abiotic Effects

Construction at the LACBWR resulted in the filling in of approximately 27 acres of land. The land committed to the LACBWR site is roughly one-third of the 163.5 acre site occupied by two fossil fuel plants and LACBWR. No further construction is proposed in this licensing action.

If one assumes an 80% capacity factor, approximately 2.0×10^{10} gallons per year of river water will pass through the plant for condenser cooling. About 1.1×10^{9} gallons per year of river water are used in the plant low-pressure system. Due to hydraulic turbulence at the outfall, there will be rapid mixing of the heated effluent. Evaporative water loss will be negligible relative to the river flow. Another $.8 \times 10^{7}$ gallons per year of groundwater are used during plant operation. Some of this water appears to be drawn from the river through the alluvium.

10.1.2 Biotic Effects

Construction of the plant resulted in loss of habitat for organisms resident prior to construction. However, because of the smallness of the site and the abundance of similar habitat nearby, it is unlikely that this damage extended beyond the immediate vicinity of the plant.

To date, the operation of the LACBWR has not revealed any major adverse impact on the aquatic biota.

The staff does not believe that any adverse radiological effects will occur. As described in Chapters 3 and 5, the estimated radiation doses to individuals and to the population from normal operation of the plant support the conclusion that the releases of radioactive materials in liquid and gaseous effluents are as low as practicable, and minimal in nature.

10.2 RELATIONSHIPS BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENCHANCEMENT OF LONG-TERM PRODUCTIVITY

10.2.1 Summary

The National Environmental Policy Act (NEPA) requires the staff to weigh specifically the long-term maintenance and enhancement of economic productivity of the continued operation of LACBWR, and of alternative "short-term uses of man's environment." In this context, short-term is taken to mean the period of operation, and long-term to mean the period beyond the service life of the plant.

The economic productivity of the site while it is used to generate electricity will be significant compared with dismantling the plant for agricultural or other likely uses of the site. The operation of LACBWR will continue to support the region's economy which will result in a corresponding large increase in the long-term productivity, compared to a smaller long-term effect for uses other than power generation. The principal effects of operation of LACBWR adverse to long-term productivity are the consumption of depletable resources and the cost of decommissioning. The overall conclusion of the staff with regard to long-term productivity is that the negative aspects of operating LACBWR are overbalanced by the positive long-term effects.

10.2.2 Enhancement of Productivity

The LACBWR is capable of producing about 50 WMe of power, which is 7% of the applicant's installed capacity in 1976.

Within Vernon County, where the environmental impacts will be the greatest, the payment of taxes to the county should tend to enhance local long-term productivity. At the end of the plant's useful life, valuable properties will remain. If these facilities were continued in use for power generation and distribution, the region's long-term productivity will continue to be enhanced. When the site area is finally abandoned for power generation purposes, productive use of the filled-in site for recreation can be envisioned.

10.2.3 Decommissioning and Land Use

A license to operate a nuclear power plant is issued for a term not to exceed 40 years, beginning with the issuance of the construction permit.[1] Since the LACBWR construction permit was issued in 1962, the remaining term for the license is about 20 years. At the end of the specified period, the operator of a nuclear power plant must renew the license for another time period or must dismantle the facility and dispose of its components.[2] Prior to the expiration of the operating license, if technical, economic, or other factors are unfavorable to continued operation of the plant, the operator may elect to apply for license termination and dismantling authority at that time. In addition, at the time of applying for a license to operate a nuclear power plant, the applicant must show that he possesses "or has reasonable assurance of obtaining the funds necessary to cover the estimated costs of permanently shutting the facility down and maintaining it in a safe condition."[3] These activities, termination of operation and plant dismantling, are generally referred to as "decommissioning."

NRC regulations do not require the applicant to submit decommissioning plans at the construction permit stage; consequently, no definite plan for the decommissioning of the plant has been developed. At the end of the plant's useful lifetime, the applicant will prepare a proposed decommissioning plan for review by the Commission. The plan will comply with NRC rules and regulations then in effect. At this time, Regulatory Guide 1.86 provides guidance on methods and procedures for the termination of operating licenses for nuclear reactors.[4]

Although no large-scale nuclear power plants have been decommissioned, experience in the decommissioning of small reactors is available. As of 1975, five licensed nuclear power plants, four demonstration nuclear power plants, six licensed test reactors, 28 licensed research reactors, and 22 licensed critical facilities had been or were in the process of being decommissioned.[5] The primary methods of decommissioning are mothballing, entombment, dismantling, or a combination of these three alternatives. The three primary methods are defined below in terms of the definitions provided in Regulatory Guide 1.86.

<u>Mothballing</u> is the process of placing a facility in a nonoperating status. The facility may be left intact except that all reactor fuel, radioactive fluids, and nonfixed radioactive wastes (e.g., ion exchange resins) are removed from the site. The existing license is amended to a "possession-only" status and continues in effect until residual radioactivity is removed or is at a level acceptable for unrestricted access. The "possession-only" license is a reactor facility license that permits a licensee to possess the facility, but prohibits operation of the facility as a nuclear reactor. Adequate radiation monitoring, environmental surveillance, and security procedures must be maintained to ensure that the health and safety of the public are not endangered.

<u>Entombment</u> consists of removing all fuel assemblies, radioactive fluids, and wastes followed by the sealing of remaining radioactive material within a structure integral with the biological shield or by some other method to prevent unauthorized access into radiation areas. A program of inspection, facility radiation surveys, and environmental sampling is required for a licensee's facility that has been entombed.

<u>Dismantling</u> is defined as removal of all fuel, radioactive fluids and waste, and all radioactive structures. Surface contamination levels for unrestricted access, which must be met prior to termination of the facility license, have been established in Table 1 of Regulatory Guide 1.86. In addition to surface contamination levels, the acceptability of the presence of materials that have been made radioactive by neutron activation would be evaluated on a case-by-case basis prior to termination of the license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

The alternative costs, given below, are stated in 1975 dollars (1980 costs would be 40% higher based on 7% annual inflation rate).

The mothballing alternative costs about $2.45 million initially plus an annual maintenance and surveillance cost of $167,000. If a 24-hour manned security force is not required (e.g., a site with continuing operations), the annual cost could be reduced to $88,000.

The entombment alternative costs about $7.58 million initially plus an annual maintenance and surveillance cost of $58,000 for the duration of the entombment period.[6]

The dismantling alternative costs about $26.3 million to remove the radioactive structures associated with NRC requirements for terminating a possession-only license. An additional $4.8 million would be needed to remove the nonradioactive structures (cooling towers, administrative buildings, etc.) to below grade.[6] There are no annual costs associated with this alternative.

Combinations of mothballing and delayed (about 100 years) dismantling have 30-year levelized unit costs that are about the same as the mothballing alternative costs. Likewise, the costs for the entombment-delayed dismantling combinations are about the same as the entombment costs. In both instances, the annual maintenance cost for the mothballing and entombment alternatives, when converted to a common basis, is sufficient to cover all the delayed dismantling cost for the mothballing alternative and about 80% of that for the entombment alternative.

The above costs are for a large one-unit station. No specific study of costs for LACBWR decommissioning has been done, but the costs stated above would be significantly less, probably by about half.

Studies of social and environmental effects of decommissioning large commercial power generating units have not identified any significant impacts beyond those already known. Each alternative will have radiological impacts associated with the transportation of radioactive material, but those should be no different than those associated with transportation impacts during normal facility operation. Also, studies indicate the occupational radiation doses can be controlled to levels comparable to occupational doses experienced with operating reactors through the use of appropriate work procedures, shielding, and remotely controlled equipment. To date, experience at decommissioned facilities has shown that the occupational exposures are generally less than those associated with the facility when operational.

The applicant may retain the site for power generation purposes indefinitely after the useful life of the station. The degree of dismantlement would normally be determined by an economic and environmental study comparing land and land values with the cost of complete demolition and removal of the complex. In any even, decommissioning will be controlled by rules and regulations in effect at the time to protect the health and safety of the public.

10.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Numerous resources are used in construction and operation of a major facility such as this plant. Some of these uses involve irreversible and irretrievable commitments.

Irreversible commitments concern changes set in motion by the proposed action that at some later time could not be altered so as to restore the present order of environmental resources. Irretrievable commitments are the use or consumption of resources that are neither renewable nor recoverable for subsequent utilization.

10.3.1 Commitments Considered

The types of resources of concern in this case can be identified as: (1) material resources--renewable resource material consumed in operation, and depletable resources consumed--and (2) nonmaterial resources, including a range of beneficial uses of the environment.

Resources that, generally, may be irreversibly commited by operation are: (1) biota destroyed in the vicinity, (2) materials that cannot be recovered and recycled with present technology, (3) materials that are rendered radioactive but cannot be decontaminated, (4) materials consumed or reduced to unrecoverable forms of waste, including uranium-235 and -238 consumed, (5) the atmosphere and water bodies used for disposal of heat and certain waste effluents, to the extent that other beneficial uses are curtailed, and (6) land areas rendered unfit for their original uses.

10.3.2 Biotic Resources

Construction of the plant has resulted in the permanent loss of some biotic habitat. No rare or endangered species were known to have inhabited the site. The habitats lost were small in total area, and the total of such habitat remaining and undisturbed by station construction and operation is extremely large. Operation of the plant is not expected to result otherwise in permanent damage to the biota.

10.3.3 Replaceable Components and Consumable Materials

Uranium is the principal natural resource irretrievably consumed in plant operation. The staff estimates that about 86 metric tons of natural uranium (in the form of U_3O_8) must be produced to supply LACBWR for 30 years. For practical purposes, other materials consumed (Table 10.3-1) are fuel-cladding materials, reactor-control elements, other replaceable reactor core components, chemicals used in processes such as water treatment and ion-exchanger regeneration, ion-exchanger resins, and minor quantities of materials used in maintenance and operation.

10.3.4 Water and Air Resources

The Mississippi River and the atmosphere have very large dispersive capacities as well as substantial self-cleansing capabilities. Consequently, the use of these resources to dilute and disperse the relatively small quantities of heat, chemicals, and radioactivity from LACBWR is not an irreversible or irretrievable commitment of these resources. It can be reasonably expected that on the cessation of LACBWR operation no permanent effects on air and water resources will be detectable.

The several dozen acres filled with dredged material may be considered to be permanently lost as aquatic habitat.

10.3.5 Land Resources

The small area necessary to store the plant's radioactive components at the end of its service life may be regarded as irreversibly and irretrievably committed.

10.4 BENEFIT-COST BALANCE

The staff estimates of the environmental and economic benefits and costs to be expected from continued operation of LACBWR have been developed in earlier sections of the statement. These estimates are reviewed below and the staff assessment of the balance between benefits and costs is developed. It supports the conclusion that continued operation of LACBWR is desirable.

10.4.1 Benefits and Costs

The primary benefits expected from continued operation of the plant are the generation of 160 to 200 million kWh/yr (approximately 0.4-0.5 load factor) and the maintenance of an additional 50 MWe in generating capability. The loss of generating capability would slightly lower the reliability of electric service in the upper Mississippi valley region in the short term. In the longer term, it would accelerate the construction of new generating units and/or require that new units be larger size, with some increase in economic and environmental cost.

The environmental costs associated with the nuclear fuel cycle have been listed in Section 5.8. The staff believes that the fraction of the overall environmental effects of the uranium fuel cycle due to LACBWR operation represents a sufficiently small environmental impact as not to affect significantly the conclusion of the benefit-cost balance.

The only environmental effects associated with the continued operation of the plant appear to be the discharge of amounts of radioactivity to the environment which are a small percentage of the natural levels of radioactivity in the environment and an impact on Mississippi River aquatic life from withdrawal and discharge of cooling water which is not discernible. According to the assessment of Section 5, LACBWR meets the "as-low-as-is-reasonably-achievable" criterion of the NRC for radioactive discharges. The effects of river life are not discernible and what little impact does occur will be reversible.

10.4.2 Benefit-Cost Balance

In the staff's opinion, the benefits of continued production of electrical energy by the plant and its contribution to DPC's generating reserves outweigh the minimal environmental effects caused by its continued operation, as well as the alternatives of higher cost replacement power, and the economic and environmental costs of new construction. (See Sec. B)

Table 10.3-1. Estimated Quantities of Materials Used in Reactor Core Replaceable Components of Water Cooled Nuclear Power Plants

Material	Quantity Used in Plant[a] (kg)	World Production[b] (metric tons)	U.S. Consumption (metric tons)	U.S. Reserves[b] (metric tons)	Strategic & Critical Materials[c]
Antimony	0.04	65,000	37,000	100,000[d]	Yes
Beryllium	0.07	288	308	72,700	Yes
Boron	84	217,000[e]	79,000[e]	33×10^6	No
Cadmium	5	17,000	6,800	86,000	Yes
Chromium	2,725	1,590,000	398,000	2×10^6[d]	Yes
Cobalt	1.5	20,200	6,980	25,000[d]	Yes
Gadolinium	66	8[f]		14,920[g]	No
Iron	11,000	574×10^6[h]	128×10^6[i]	2×10^9[d]	No
Nickel	1,380	400,000[i]	129,000[i]	181,000[d]	Yes
Tin	7,850	248,000	89,000	57,000[d]	Yes
Tungsten	0.23	35,000	7,300	79,000	Yes
Zirconium	27,650	224,000[e]	71,000	51×10^6	No

[a]Quantities used are modified from the final ER for Hope Creek Generating Station, Table 10.1, Docket Nos. 50-354 and 50-355.

[b]Production, consumption, and reserves were compiled, except as noted, from the U.S. Bureau of Mines publications, "Mineral Facts and Problems" (1970 ed. Bur. Mines Bull. 650) and "1969 Minerals Yearbook."

[c]Designated by G.A. Lincoln, "List of Strategic and Critical Materials," Office of Emergency Preparedness; Fed. Regist. 37(39):4123, February 26, 1972.

[d]World reserves are much larger than U.S. reserves.

[e]Information for 1968.

[f]Production of gadolinium is estimated for 1971 from data for total separated rare earths given by J.G. Cannon, Eng. Mining J. 173(3):187-200, March 1972. Production and reserves of gadolinium are assumed to be proportional to the ratio of gadolinium to total rare earth content of minerals given in "Comprehensive Inorganic Chemistry," Vol. 4, p. 153, M.C. Sneed and R.C. Brasted, Eds., D. Van Nostrand Co., Princeton, NJ, 1955.

[g]Reserves include only those at Mountain Pass, CA, according to the "1969 Minerals Yearbook."

[h]Excludes quantities obtained from scrap.

[i]Production of raw steel.

References

1. U.S. Nuclear Regulatory Commission, Rules and Regulations, 10 CFR 50, "Licensing of Production and Utilization Facilities," §50.51, "Duration of License, Renewal."

2. Ibid., §50.82, "Applications for Termination of Licenses."

3. Ibid., §50.33, "Contents of Applications; General Information."

4. "Termination of Operating Licenses for Nuclear Reactors," U.S. Nuclear Regulatory Commission, Regulatory Guide 1.86, June 1974.

5. P.B. Erickson and G. Lear, "Decommissioning and Decontamination of Licensed Reactors, Facilities, and Demonstration Nuclear Power Plants," presented at the Conference on Decontamination and Decommissioning, Idaho Falls, ID, August 19-21, 1975.

6. "Decommissioning of Nuclear Facilities - An Annotated Bibliography," prepared by Battelle - Pacific Northwest Laboratory, U.S. Nuclear Regulatory Commission, NUREG/CR-0131, October 1978.

11. DISCUSSION OF COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL STATEMENT

Pursuant to Paragraph A.6 of Appendix D to 10 CFR Part 50, the Draft Environmental Statement for the La Crosse Boiling Water Reactor was transmitted, with a request for comments, to:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Health, Education, and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Federal Energy Administration
Federal Power Commission
Wisconsin Department of Natural Resources
Wisconsin Public Service Commission
Wisconsin Department of Administration
Iowa Office for Planning and Programming
Minnesota State Department of Health

In addition, the NRC requested comments on the Draft Environmental Statement from interested persons by a notice published in the "Federal Register" on June 24, 1976. In response to the requests referred to above, comments were received from:

Advisory Council on Historic Preservation (ACHP)
Department of Agriculture (AGR)
Department of Commerce (COMM)
Department of Health, Education, and Welfare (HEW)
Department of the Interior (DOI)
Environmental Protection Agency (EPA)
Energy Research and Development Administration (ERDA)
Mississippi River Regional Planning Commission (MRRPC)
Wisconsin Department of Natural Resources (WDNR)
Wisconsin Department of Administration (WDA)
Wisconsin State Historical Society (SHPO)
Iowa Office for Planning and Programming (IOPP)
The Kickapoo Scout (KICK)
Dairyland Power Cooperative (DPC)

The comments are reproduced in this Statement as Appendix A. The staff's consideration of the comments received and its disposition of the issues involved are reflected in part by revised text in the pertinent sections of this Final Environmental Statement and in part by the following discussion. The comments are referenced by use of the abbreviations indicated above; also, the pages in Appendix A on which copies of the comments appear are indicated.

11.1 INTRODUCTION

No comments.

11.2 THE SITE

11.2.1 <u>Location of Hospitals</u> (WDNR: A-18)

The availability of hospitals and ambulance service, as it applies to plant incidents, will be discussed in Section 13 of the Safety Evaluation Report. Local medical facilities are not expected to be stressed by the routine requirements of the operating staff and their families.

11.2.2 Aquatic Biota (WDNR: A-19)

A recent study conducted by WAPORA, Inc. investigated plankton and benthic organisms in the vicinity of the site. Phytoplankton were abundant in the river adjacent to the site, but little difference was observed in the concentrations above and below the plant discharge. Zooplankton populations were primarily composed of copepod taxa and no major differences were noted between samples collected upstream, downstream, or in the area of the discharge (Table 11.2-1). Benthic macroinvertebrates showed some differences in taxa, but no significant differences were noted in organism abundance at stations above, below, and near the plant discharge (Table 11.2-2). Both the planktonic and benthic taxa observed were typical inhabitants of the upper Mississippi River.

Table 11.2-1. Zooplankton (in organisms per liter) Collected at the Genoa, Wisconsin Site, September 3-6, 1974 (See Section 5.3 for map of sampling stations)

Transect	Rotifers	Copepods	Cladocerans	Nauplii	Total
A 1	3.9	17.3	3.0	0.7	24.8
A 2	1.7	16.0	9.2	0.9	27.9
A 3	0.4	16.6	3.3	0.3	20.5
A 4	0.6	36.2	5.3	0.3	42.5
A 5	0.5	19.5	4.4	0.5	25.0
A 6	0.6	28.3	5.8	0.1	34.9
A 7	0.5	22.1	5.3	0.3	28.2
A 8	0.5	47.9	7.2	0.2	55.9
A 9	0.0	39.8	6.4	0.9	47.2
A 10	0.5	29.2	6.7	0.8	37.2
B 1	0.8	23.5	10.9	0.6	35.7
B 2	1.4	16.6	6.6	1.1	25.7
B 3	0.0	15.8	8.6	0.6	25.0
B 4	0.0	20.5	7.1	0.3	27.9
B 5	0.1	29.2	7.7	0.9	38.0
B 6	0.2	40.0	17.2	0.7	58.1
B 7	0.2	38.8	11.7	0.8	51.5
B 8	0.0	23.7	5.9	0.3	29.8
B 9	0.3	31.2	7.8	1.0	40.2
B 10	0.1	32.3	8.4	0.3	41.2
C 1	0.4	17.8	4.0	0.4	22.6
C 2	1.5	25.0	5.4	1.1	33.0
C 3	0.0	46.4	21.2	1.2	68.8
C 4	0.0	16.4	5.4	0.1	21.9
C 5	0.0	19.7	2.7	0.4	22.8
C 6	0.0	18.8	5.7	0.1	24.7
C 7	0.5	20.7	3.1	0.2	24.4
C 8	1.2	30.4	6.0	1.4	39.0
C 9	0.0	39.1	5.9	0.5	45.5
C 10	3.3	49.6	6.0	0.5	59.4
D 1	0.6	18.3	4.0	1.3	24.2
D 2	0.8	12.7	3.3	0.2	17.0
D 3	0.0	18.3	4.5	0.3	23.1
D 4	0.0	14.5	5.0	0.5	20.0
D 5	1.0	16.5	8.7	0.3	26.5
D 6	1.2	17.8	6.6	0.3	25.9
D 7	0.3	17.3	5.8	0.5	24.0
D 8	0.4	19.1	3.2	0.2	22.9
D 9	1.5	36.9	12.2	0.8	51.4
D 10	1.1	46.5	7.5	0.6	55.8

Table 11.2-2. Mean Abundance of Macroinvertebrates Collected on Rock Baskets Placed Above, Below and At the Discharge of the Genoa Power Station During August and September 1974 (Based on data from the WAPORA study. See Sec. 5.3 for map of sampling stations)

Taxa	Upstream	Discharge	Downstream
Hydra sp.	112.5		594.8
Bryozoa	0.3	1.0	0.8
Turbellaria	303.8	106.7	202.5
Hirudinea			2.5
Tubificidae		1.3	
Gammarus sp.	136.3	30.0	52.0
Microcylloepus sp.		6.7	
Berosus sp.			2.5
Chironominae pupae	26.3	3.3	62.5
Chironaminae unid	685.0	366.7	2120.5
Caenis sp.			5.0
Tricorythodes sp.	10.0	3.3	3.0
Stenonema sp.	78.8	20.0	23.3
Ischnura sp.		3.7	
Trichoptera pupae	151.3	153.3	88.8
Cheumatopsyche sp.	4020.0	3230.0	113.8
Hydropsyche frisoni	11.3	10.0	
Hydropsyche orris	958.8	1013.3	
Potamyia flava	718.8	2336.7	
Leptocella candida			2.8
Neureclipsis sp.	55.0	6.7	16.8
Polycentropus sp.	130.0	6.7	405.0
Psychomyiid genus A	55.0		972.8
Pleurocera sp.	0.8		
Total Number of Organisms	7453.5	7299.3	4669.0

11.2.3 Effects of Thermal Effluent on Groundwater (DOI: A-5, WDNR: A-18)

As stated in Section 2.5.2, the groundwater gradient is toward the river. Further, even if recharge from the river maintains water level in the shallow field, the rate of permeation of water through the soils is sufficiently slow and the thermal and chemical gradient sufficiently small so that changes in temperature and chemical gradient would be small and undetectable more than a short distance from the river bank or beyond the plant area. The wastewater in the Genoa 1 ashpit is not monitored; however, the distance and direction to the nearest well from the ashpit (about 2500 ft south) relative to the distance to the river (about 250 ft east) makes contamination of the wells extremely unlikely.

11.3 THE PLANT

11.3.1 Qualifications of Genoa Volunteer Fire Department (MRRPC: A-16)

This matter is not part of the environmental review of this facility but will be considered as part of the staff's safety evaluation, which will be completed at a later date.

11.3.2 Security Measures (WDNR: A-18)

This matter is not part of the environmental review of this facility but will be considered as part of the staff's safety evaluation, which will be completed at a later date.

11.4 ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND PLANT CONSTRUCTION

11.4.1 Impact of Landfill During Plant Construction (WDNR: A-18)

The filling of the forest ponds and dredge and fill operations resulted in loss of habitat and the associated biota. However, the disturbed ponds were not rearing or spawning habitat for maintenance of fish populations in the river. The amount of habitat was small relative to the total amount extant, and there is no evidence it possessed exceptional attributes. The addition of riprap to the river bank in the filled area increases substrate diversity and surface area, providing increased habitat for benthic flora and fauna. In addition, it provides additional forage and cover for fish and may enhance production along the river bank. The disturbance due to dredging should not have resulted in any long-term modifications of the biota, not only because benthic populations quickly recover from such stresses, but also since the aquatic community was and is frequently stressed by a variety of insults ranging from natural floods to churning from barges. No monitoring program was conducted by the applicant that confirms these conclusions. However, since the area affected was quite small (26.8 acres) and contained no unique habitat, it is the opinion of the staff that permanent environmental stress due to site preparation and construction was minimal.

11.5 ENVIRONMENTAL EFFECTS OF OPERATION OF THE PLANT AND TRANSMISSION FACILITIES

11.5.1 Compliance with Section 102(2)(C) of NEPA Concerning Cultural and Historic Resources (ACHP: A-1)

The staff, in consultation with the Acting State Historic Preservation Officer (SHPO) of Wisconsin, has determined that operation of LACBWR will have no effect on any property in, or eligible for inclusion in, the National Register of Historic Places. The most recent comments of the Acting SHPO of Wisconsin are included on page A-20 of Appendix A.

11.5.2 Dissipation of Heated Effluent (WDNR: A-19)

Heated effluent from LACBWR and the Genoa 3 generating station are combined and discharged to Thief Slough. A rock-fill dam and river flow patterns prevent dispersion of the heated effluent into the main channel of the Mississippi River. The range of ΔT values at the discharge has been 8°F-12°F in the summer and 23°F-35°F during winter months. The results of an analysis of the dispersion plume (conducted by the staff, Sec. 5.3) showed that the 5°F isotherm for LACBWR operating alone would include an area of 730 ft^2 and extend 210 feet downstream during minimum flow conditions. The plume would be 25% of the cross-sectional area of the stream during minimum flow, but only 6% during average flow. The 5°F isotherm describes the limits of the mixing zone according to the WPDES permit. As a simplifying assumption in the model, the thermal plume is assumed isothermal in each cross section perpendicular to the flow direction. As shown by Ranthum's measurements, the deviations from complete mixing are small beyond the mixing zone. The permit further limits the mixing zone to no more than 25% of the cross-sectional area of the receiving body, and the zone may not extend beyond 50% of the width. Thermal mapping has shown that the discharge plume and mixing zone were within the requirements of the WPDES permit.

Although the ΔT values have on occasion been high and may result in some adverse effects on biota, the mixing zone is small and extends only a few hundred feet downstream below the discharge during worst conditions (low flow). Dissipation of the heat may be enhanced by turbulent mixing and higher water velocity produced by the rock-fill dam.

The applicant could not detect unambiguous adverse effects of heat on the distribution or abundance of plankton, benthic macroinvertebrates, or fish during investigations of the biota at stations located above, below, and within the mixing zone area.

11.5.3 Intake Structure Impact Assessment (EPA: A-7)

Cooling water is withdrawn from the river through a canal-type intake structure. The canal is 50 feet long and extends into the river approximately 35 feet. The canal depth is at an elevation of 612 feet MSL, eight feet below normal pool level (Fig. 11.5-1). Water enters the canal from the river, passes through a set of trash racks and a traveling screen with 3/8-inch mesh, and enters the water box where the service water and circulating water pumps are located. Design and operational data are given in Table 11.5-1.

The applicant has applied for and received a WPDES permit in compliance with Section 147.02(6), Wisconsin statutes. The Wisconsin DNR[1] cites three reasons for granting the permit based on the WAPORA 316(b) report:[2] (1) the impingement of fish was 0.01% by weight of the reported average commercial catch in 1970-1974; (2) white bass, a fairly prolific species, accounted for 95% of entrained fish larvae; and (3) no harmful effects of impingement or entrainment could be detected for the sport or commercial fishery in Pool No. 9.

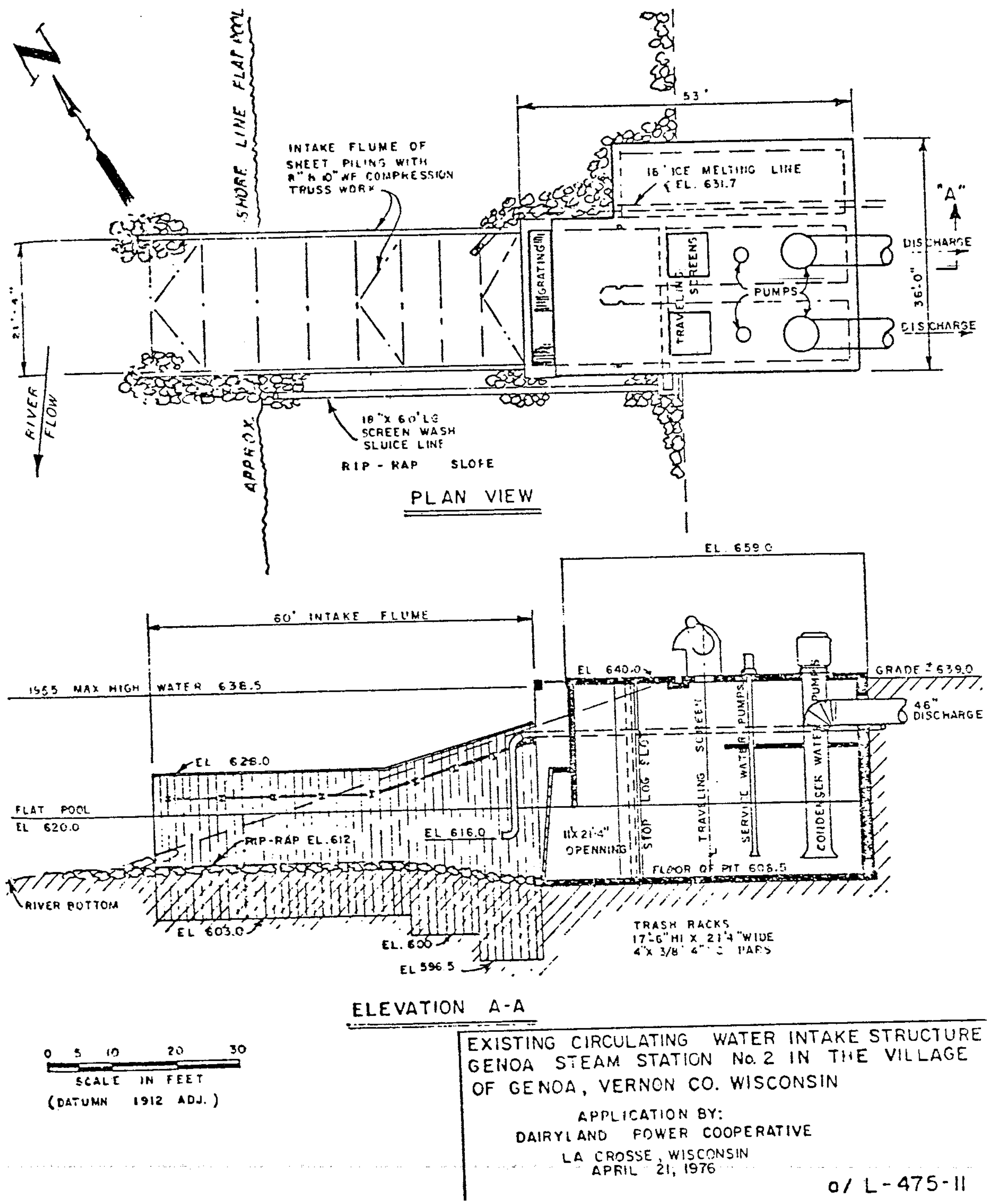

Fig. 11.5-1. Location and Design of the LACBWR Intake Structure.

Table 11.5-1. Data for the LACBWR Intake Structure

Number of traveling screens	2
Height of each traveling screen (feet)	35
Width of each traveling screen (feet)	6
Square feet of surface for each traveling screen	210
Total square feet of surface for two traveling screens	420
Mesh size of each screen (inches)	3/8
Fish saving devices	None
Number of intake pumps	2
Maximum capacity of all pumps (gpm)	64,000
Maximum capacity of all pumps (Mgd)	92
Percent river use at 92 Mgd, average river flow of 33,830 cfs	0.4
Measured velocities (fps):	
Range	0.5-0.8
Average	0.66

Although the staff does not concur with all aspects of the studies and results presented, after reviewing the 316(b) report the staff does agree with the overall evaluation that the fish of Pool No. 9 are not subjected to an unacceptable level of impacts. The staff does not agree that the intake design reflects the best technology currently available. By the issuance of the WPDES permit, the State of Wisconsin has accepted the intake design as adequate to meet the requirements of the permit.

The staff concludes that the monitoring and review requirements described in Section 5 are sufficient to document the aquatic environmental impacts of operating LACBWR.

11.5.4 Impact of Cold Shocks on Aquatic Biota (WDNR: A-19)

It is unlikely that Genoa 3 and LACBWR would be shut down simultaneously. However, should this occur, the potential for large fish kills due to cold shock is low since the submerged wing-dam immediately upstream from the mixing zone promotes rapid mixing of the thermal effluent, reducing the plume area. A monthly fish sampling program conducted by the State of Wisconsin (DNR) showed no evidence of unusual fish concentrations in the mixing zone in mid and late winter.[3] These observations support the contention that the potential for large fish kills due to cold shock is low.

11.5.5 Impact of Variations in Current Velocity and Sediment Type on Macrobenthos Sampling (WDNR: A-19)

Since no data are available on these variables, their influence on macrobenthos cannot be addressed. However, the data provided by the applicant show no significant differences in macroinvertebrate abundance and very little difference in community structure among the samples from the different transects.

11.5.6 Impact of Entrainment on Aquatic Biota (EPA: A-7, WDNR: A-19)

At most, about 2.5% of the 7-day, 10-year low flow of the river passes through LACBWR. If 100% mortality of entrained organisms is assumed due to passage through the station, about 2.5% of the river's entrainable biota will be killed. This assumes that the entrainable biota are evenly distributed throughout the river at this point. The presence of lock and dam No. 8, located about 3300 feet upstream from the intake, indicates that entrainable biota will be evenly distributed below the dam due to turbulent mixing. River velocity in the vicinity of the intakes ranges from 1 to 3 fps. At this rate the transport time from the dam to the intakes ranges from 20 minutes to one hour. It is unlikely the entrainable biota could become concentrated in the intake area during this period of time. Therefore, these observations support the assumption that entrainment impacts are proportional to intake volume. On the other hand, if death is due only to exposure of the entrained organisms to the highly toxic chlorinated effluent of Genoa 3, the chlorination period (twice daily for 20 minutes) will result in about 0.1% mortality. Consequently, under low flow conditions mortality will lie somewhere between 0.1% and 2.5%, and

under normal flow conditions it will be less. Organisms that are killed would be available as particulate food for other organisms until decomposition, at which point their nutrients would be released and available. At this low mortality range, no damage of importance to river populations is expected.

During 1978 and 1979 monthly average concentrations of total residual chlorine at the discharge ranged from 0.01 to 0.13 mg/L. The maximum value was 0.2 mg/L. Chlorination of Genoa 3 is controlled by the WPDES permit and is a matter over which the staff has no jurisdiction.

11.5.7 Impact of Barge Traffic in Thief Slough (WDNR: A-19)

Barge traffic in Thief Slough is associated with Genoa 3 (coal-fired) and is not a result of operation of LACBWR.

11.5.8 Impact of Thermal Plume (WDNR: A-19)

Fish spawning and migration in Pool No. 9 does not appear to be affected by operation of the LACBWR. Spawning in the upper reach of Thief Slough, coincident with the thermal mixing zone, is minimally affected by the thermal effluent. Physical constraints to spawning imposed by high current velocity (5-10 fps) and periodic maintenance dredging of the navigable channel (i.e., removal of substrate, vegetation, and protective cover) preclude suitable spawning habitat for indigenous fish species in the area of the thermal plume. Fish migration in Pool No. 9 is restricted by dams No. 8 and 9. The Bad Axe River, which discharges 4.5 miles south of LACBWR into Pool No. 9, is the only major tributary entering the impoundment that offers tributary spawning habitat. Access to this stream for migrating fish is unaffected by the thermal discharge from LACBWR.

Therefore, the staff concludes that adverse environmental impacts of the heated effluent are minimal and limited to a small portion of the mixing zone. No impacts of heated effluent are expected beyond the mixing zone provided the area affected and the ΔT values are maintained within the limits of the WPDES permit.

11.5.9 Flooding (EPA: A-14)

The likelihood of flooding of the site due to various causes, including failure of upstream dams, is covered in the safety review.

11.5.10 Compliance with Appendix I to 10 CFR Part 50 (EPA A-7, A-9, A-11, HEW A-4, WDNR A-18, Applicant A-24

In conformance with the requirements of Section V.B of Appendix I, Dairyland Power Cooperative (DPC) filed with the Commission on June 3, 1976, and in subsequent submittals dated November 17, 1976, May 18, 1977, June 24, 1977, July 29, 1977, February 23, 1978, and July 12, 1978, the necessary information to permit an evaluation of the La Crosse Boiling Water Reactor, with respect to the requirements of Appendix I.

The staff has reviewed this information, as well as operating experience related to the releases of radionuclides in plant effluents as provided in the La Crosse Semi-Annual Effluent Release Reports. The estimated source term based on this data as well as the evaluation performed to determine conformance with the requirements of Appendix I to 10 CFR Part 50 are contained in Section 3.6.

11.5.11 Monitoring and Sampling of Effluents (ERDA A-15, #1, #2, WDNR A-18)

Sampling and analysis of each batch of radioactivity about to be released. Radioactivity monitors in the liquid effluent discharge line activate a high radioactivity alarm in the control room which results in closure of the liquid effluent discharge valve if predetermined limits are exceeded. The monitor predetermined release limits, and the sampling, analysis, and monitoring procedures are specified in the radiological effluent technical specifications for La Crosse. The predetermined limits are set at such a level to ensure that the release limits of 10 CFR Part 20 are not exceeded at any time.

11.5.12 Solid Waste (ERDA A-15 #3, WDNR A-18)

As indicated in NRC Regulatory Guide 1.21, the total curie quantity and radionuclide composition of solid waste shipped offsite is determined. The activities can be obtained by such methods as sampling of the waste to be solidified, and monitoring of the drum contents. The burial sites where the solid wastes from La Crosse can be shipped, which are open at the present time, are Barnwell, South Carolina; Beatty, Nevada; and Hanford, Washington. On site storage is available for holding drums or shipping containers prior to shipment.

11.5.12 Use of PCBs (EPA: A-14)

The applicant has stated that materials containing PCBs are not presently used on the site and there are no plans to use any such materials in the future.

11.6 ENVIRONMENTAL MEASUREMENTS AND OPERATIONAL MONITORING PROGRAMS

No comments.

11.7 ENVIRONMENTAL IMPACT OF POSTULATED ACCIDENTS

11.7.1 Transportation of Solid Radioactive Waste (WDNR: A-18)

Handling of solid waste and its transportation will be in accordance with both NRC and Department of Transportation regulations.

11.7.2 Plant Security (WDNR: A-18)

Protection of the facility against sabotage and unauthorized access is covered in the safety review.

11.7.3 Probability of Major Accidents (WDNR: A-19)

Section 7 presents a discussion of the environmental risks of accidents, updated to include the experience gained in the Three Mile Island accident.

11.8 THE NEED FOR POWER

No comments.

11.9 BENEFIT-COST ANALYSIS OF ALTERNATIVES

11.9.1 System Operation and Economic Effects (WDNR: A-19, KICK: A-23, DPC: A-24)

Section 8-1 has been rewritten to respond to these comments.

11.10 EVALUATION OF THE PROPOSED ACTION

11.10.1 Uranium-Resource Availability (WDNR: A-19)

Information available from the U.S. Department of Energy on the domestic uranium-resource situation and the outlook for development of additional domestic supplies, availability of foreign uranium, and the relationship of uranium supply to planned nuclear generating capacity--including information developed in the National Uranium Resource Evaluation program--is presented in NUREG-0522.[4]

11.10.2 Decommissioning (ERDA: A-15)

As discussed in Section 10.2.3, detailed consideration of decommissioning will be done near the end of a reactor's useful life. A method cannot be selected now, since the considerations of land values, need for surveillance, costs of restoration of the site, and other environmental concerns will need to be assessed as part of the overall review of decommissioning at that time. The applicant would be responsible for such surveillance and its cost, if it were needed. A fuller discussion of staff considerations of decommissioning is given in Regulatory Guide 1.86.[5]

References

1. Letter from Thomas A. Kroehn, Administrator, Wisconsin DNR, Division of Environmental Standards, to J.P. Madgett, General Manager, Dairyland Power Cooperative, September 20, 1977.

2. "La Crosse Boiling Water Reactor (LACBWR) Cooling Water Intake Structure, Dairyland Power Cooperative, 316(b) Document," WAPORA, Inc., report submitted to Dairyland Power Cooperative, 68 pp. and App., 1976.

3. R.G. Ranthum, Wisconsin Department of Natural Resources, Division of Forestry, Wildlife, and Recreation; Bureau of Fish Management; Management Report No. 48, September 1, 1971.

4. "Draft Environmental Statement Related to Construction of Palo Verde Nuclear Generating Station Units 4 and 5," Section 10.3.4.3, U.S. Nuclear Regulatory Commission, NUREG-0522, April 1979.

5. "Termination of Operating Licenses for Nuclear Reactors," U.S. Nuclear Regulatory Commission, Regulatory Guide 1.86, June 1974.

APPENDIX A

COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

DOCKETED USNRC AUG 11 1976 Mail Section Docket Clerk

50-409

RECEIVED AUG 11 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

August 6, 1976

Mr. George W. Knighton, Chief
Environmental Project Branch No. 1
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Knighton:

Thank you for your request of June 25, 1975 for comments on the environmental statement for the LaCrosse Boiling Water Reactor, Wisconsin.

Pursuant to our responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969 and the Council's "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800), we have determined that your draft environmental statement does not contain sufficient information concerning historic and cultural resources for review purposes. Please furnish data indicating:

Compliance with Executive Order 11593 of May 13, 1971 (16 U.S.C. 470). The environmental statement must demonstrate that either of the following conditions exists:

1. A property eligible for inclusion in the National Register of Historic Places is not located within the area of environmental impact, and the undertaking will not affect any such property. In making this determination, the Council requires evidence of consultation with the appropriate State Historic Preservation Officer and evidence of an effort to ensure the identification of such properties. The Council recommends that comments of the State Historic Preservation Officer be included in the final environmental statement.

2. A property eligible for inclusion in the National Register is located within the area of environmental impact, and the undertaking will or will not affect any such property. In cases where there will be any effect, the final environmental statement should contain evidence of compliance with the Executive Order through the Council's "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800).

8134

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

Should you have any questions on these comments or require any additional assistance, please contact Charles Spilker of the Advisory Council staff (202-254-3380).

Sincerely yours,

John D. McDermott
John D. McDermott
Director, Office of Review
and Compliance

AGRICULTURAL RESEARCH SERVICE

WASHINGTON, D.C. 20250

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF ADMINISTRATOR

July 19, 1976

Mr. George Knighton
Division of Site Safety
and Environmental Analysis
Nuclear Regulatory Commission
Washington, D.C. 20555

50-409

Dear Mr. Knighton:

In response to your letter of June 25, we have reviewed the Draft Environmental Statement related to the operation of the La Crosse Boiling Water Reactor and have no comments.

We appreciate having an opportunity to review this Statement.

Sincerely,

H. L. Barrows
Deputy Assistant Administrator

7284

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
NORTHEASTERN AREA, STATE AND PRIVATE FORESTRY
6816 MARKET STREET, UPPER DARBY, PA. 19082
(215) 596-1671

8400
August 13, 1976

RECEIVED AUG 17 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Refer to: 50-409, Draft Environmental Statement, LaCrosse Boiling Water Reactor, WI

Dear Mr. Knighton:

Our Milwaukee Office has forwarded the above statement to us for review and comment as no National Forest lands are involved.

We agree that most of the effects on forested land connected with this project have already occurred. The environmental impact of operation and maintenance of the plant is adequately described.

Thank you for the opportunity to review this Draft Statement.

Sincerely,

DALE O. VANDENBURG
Staff Director
Environmental Quality Evaluation

8386

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

Regulatory Docket File

RECEIVED OCT 29 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

50-409

September 2, 1976

Director, Division of Site Safety
and Environmental Analysis
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. Fred Hebdon

Dear Sir:

The Draft Environmental Impact Statement entitled "La Crosse Boiling Water Reactor," which accompanied your letter of June 25, 1976, has been reviewed in the Department of Commerce. We have no comment to offer in this instance.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

DOCKETED USNRC OCT 29 1976

10964

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

AUG 16 1976

50-409

RECEIVED AUG 18 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

Director
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Enclosed are our comments on the draft environmental impact statement concerning the La Crosse Boiling Water Reactor.

Thank you for the opportunity to review the document.

Sincerely,

Charles Custard
Director
Office of Environmental Affairs

Enclosure

8425

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

TO : Director
Office of Environmental Affairs/DHEW

DATE: July 29, 1976

FROM : Principal Environmental Officer/H

SUBJECT: DEIS:NRC La Crosse Boiling Water Reactor

This draft environmental statement is relatively complete, however, it does have two omissions of particular interest to the Department. The report contains on page 5-10, information on the U.S. annual dose commitment to total body and to the thyroid and the annual population dose to the U.S. population in man-rem, as well as to the total body and to the thyroid from this reactor. However, there is no information concerning doses to the individuals who live close to the site. There is no way of estimating what the maximum doses to individuals might be, either from direct irradiation or from the ingestion of milk or other food crops grown in the vicinity. The draft statement does state that milk is a major commodity produced in this area.

Also, there is no detail on the ongoing or proposed operational offside radiological monitoring program. The draft statement states on page 6-2 that there is such a program and that the program is under continuous staff review and that any required changes in their program will be incorporated into the Environmental Technical Specifications for the facility. This is not a satisfactory way of describing the environmental monitoring program for the purpose of soliciting comment from other Federal agencies or from the public generally.

Boris J. Osheroff

Control Slip #722

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

RECEIVED AUG 12 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

ER 76/622

50-409

AUG 11 1976

Dear Mr. Knighton:

Thank you for your letter of June 25, 1976, transmitting copies of the draft environmental statement for La Crosse Boiling Water Reactor (operating stage), Vernon County, Wisconsin. We have the following comment:

Impacts on Water Use, Groundwater

The statement indicates that because the groundwater flow at the plant site is toward the river, effluents should not be drawn into wells (p. 5-3). Information available from maps included in the statement indicates that some clarification of this conclusion may be needed. We suggest that data on the groundwater supplied by the LACBWR wells should include temperature, in order to evaluate the potential for impact of thermal discharge on groundwater. If recharge from the river is maintaining water levels in the shallow well field, heat or other constituents of the river water may also enter the groundwater reservoir.

Figures 2.5-1 and 5.3-1 need scales in order to make them useful for impact evaluation. Specific locations of wells rather than merely a bracketed interval should be shown in figure 2.5-1.

We hope that the comment will be helpful to you in the preparation of a final environmental statement.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Mr. George W. Knighton
Chief, Environmental Projects Branch 1
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

8216

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

OCT 12 1976

50-409

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: 76-058-706
D-NRC-F06002-WI

Dear Mr. Knighton:

The Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (EIS) issued by the Nuclear Regulatory Commission in conjunction with the application by Dairyland Power Cooperative for a full-term operating license for the LaCrosse Boiling Water Reactor.

Our major concerns with the operation of this facility are the compliance with the Section 402 of the Federal Water Pollution Control Act Amendments and the ability of the facility's liquid waste treatment system to meet Appendix I requirements. Although the cooling system in general is in conformance with the requirements of EPA regulations, we believe the combined chlorine discharges are excessive. The level of chlorine discharged exceeds the levels recommended by the Wisconsin Department of Natural Resources. Therefore, we recommend the chlorination procedures be re-evaluated. Your staff has assessed the capabilities of the LaCrosse reactor with regard to the liquid radioactive waste treatment system. The estimate arrived at predicts a level of release substantially below what the plant can achieve. The estimated releases should be re-evaluated based on the practicability of operating the present system, or some indication given about what additions to the present system will be required of the licensee to achieve the releases shown in the draft statement.

In light of our review and in accordance with EPA procedures, we have rated the Draft Statement as Category 3 (inadequate information). This rating is based upon the lack of assessment of the plant's radioactive releases for comparison with Appendix I. We would be pleased to discuss our rating and comments with you or members of your staff.

Sincerely yours,

Valdas V. Adamkus
Deputy Regional Administrator

RECEIVED 10-14-76 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

ENVIRONMENTAL PROTECTION AGENCY

REGION V

CHICAGO, ILLINOIS 60604

SEPTEMBER 1976

ENVIRONMENTAL IMPACT STATEMENT COMMENTS

LA CROSSE BOILING WATER REACTOR

TABLE OF CONTENTS

INTRODUCTION and CONCLUSIONS

The Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (EIS) issued in conjunction with the application by Dairyland Power Cooperative for a full-term operating license for the LaCrosse Boiling Water Reactor. The facility is on the east shore of the Mississippi River in the Village of Genoa, Vernon County, Wisconsin. The U. S. Army Corps of Engineers Lock and Dam No. 8 is about 3300 feet upstream from the site. The following are our major conclusions

1. Although the LaCrosse Boiling Water Reactor itself does not chlorinate, Genoa 3 which shares a common discharge pipe does chlorinate. The total residual chlorine after mixing of the effluents of the two units is .75 ppm at the point of discharge into the Mississippi River. Federal Effluent Guidelines require a discharge from a generating station to be limited to 0.2 ppm free available chlorine on the average and not to exceed a maximum of 0.5 ppm. The effluent with a .75 ppm total residual concentration at the point of concentration is in violation of EPA standards and the National Pollutant Discharge Elimination System Permit (NPDES). EPA recommends that alternative methods of chlorination be evaluated to meet Federal and State water quality discharge standards for chlorine.

2. Section 316(b) of the FWPCA requires that "the location, design, construction and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impacts." The discussion of the intake system and structure should be substantially expanded to reflect more of the information available including screen design and actual measurement data to justify the conclusions presented.

3. The capabilities of the present liquid radioactive waste treatment system have been assessed by the NRC. This estimate arrived at a level of radioactive releases substantially below the level which the LaCrosse Boiling Water Reactor is capable of achieving. The estimated annual release should be re-evaluated based on the practicability of operating the present system or some indication given about what additions to the system will be required of the licensee, including the cost benefit analysis, to achieve the release shown in the draft statement.

4. The annual releases of I-131 and I-133 given in the draft statement, which have been estimated assuming continuous operation of the waste gas treatment system, are one to two orders of

magnitude above what has been reported in the LACBWR operating reports. The estimated annual releases of these two isotopes should be revised to reflect actual conditions.

5. The evaluations of the exposures (doses) which will result to members of the general population from turbine building direct radiation and N-16 skyshine, to occupational workers, do not appear to be realistic. Sufficient information exists to give accurate assessments of the environmental impacts of the doses from these sources rather than quoting documents which were developed to characterize plants twenty times the size of, and ten to fifteen years newer than LaCrosse.

6. NRC has failed to use its own documents, specifically, NUREG-0016 in estimating the annual release of C-14. Based on information in the Environmental Report and the equation for C-14 release in NUREG-0016, we calculate a release of 0.7 Ci/yr compared to 9.5 Ci/yr given in the draft statement. The C-14 estimate should be revised to reflect the parameters which characterize LaCrosse or an explanation given as to why such an assessment is inappropriate.

CONDENSER COOLING SYSTEM and FWPCA REQUIREMENTS

The LaCrosse Boiling Water Reactor (LACBWR) was completed in 1967 and has been in operation since 1969. The plant employs one boiling water reactor to produce up to 165 megawatts thermal (MWt) and 50 megawatts electric (MWe). Condenser cooling is accomplished by once-through flow of water obtained from the Mississippi River. The discharge from LACBWR will join the discharge from Genoa 3 (a 350 - MWe coal-fired generating plant) to form a common single point discharge source to the Mississippi River.

The State of Wisconsin was responsible for issuance of a discharge permit for LACBWR under the Federal Water Pollution Control Act Amendments of 1972 (FWPCA). Issuance of the permit was based upon review and analysis of all relevant information as provided and discussed in the draft statement. Consideration was given to the requirements of Section 301 and 316(a) in the granting of a NPDES Permit.

Section 301 of the FWPCA stipulates that effluent limits for various point source discharges to navigable waters shall require the application of "Best Practicable Control Technology Currently Available" no later than July 1, 1977, and "Best Available Technology Economically Achievable" no later than July 1983. The levels of technology corresponding to these terms were defined in EPA's "Stream Electric Power Generating Point Source Category Effluent Guidelines and Standards, Federal Register of October 8, 1974. The cooling system is operating in compliance with Federally approved State water quality standards in regard to the thermal component of the effluent. However, EPA is concerned about the combined chemical discharges due to the high chlorination of Genoa 3.

CHEMICAL EFFECTS

Although LACBWR does not chlorinate its condenser cooling water, Genoa No. 3 which uses a common discharge pipe in conjunction with LACBWR does chlorinate. On page 5-1 of the draft statement, it states the chlorination of Genoa 3 is performed twice daily for 20-minute periods and the total residual chlorine at the Genoa's 3 condenser outlet is 1 ppm. It further states that the total residual chlorine content after mixing with LACBWR effluent is .75 ppm at the point of discharge into the Mississippi River. The chlorine content after travelling 100 seconds and mixing with the river is .05 ppm.

The Federal steam electric guidelines of October 8, 1974, require that a discharge from a generating unit meet a limitation of 0.2 ppm free available chlorine on the average and not exceed a maximum of 0.5 ppm. The release of chlorine is limited to two-hours per day for each unit. Less stringent limitations may be imposed if the applicant can demonstrate that a unit in a particular location cannot operate at or below this level of chlorination, and if such higher concentration limits will meet applicable requirements of water quality standards. This has not been demonstrated for LaCrosse and, thus the effluent with a .75 ppm total residual concentration at the point of discharge is in violation of EPA standards and NPDES permit requirements. The use of a mixing zone in the river for the dilution of toxic chlorine is an inadequate means of biocidal control. Furthermore, it should be recognized that the Wisconsin Water Quality Standards require that the concentration of total residual chlorine not to exceed the 96-hour TLM for fish, or fish-food organisms at any point in the mixing zone.

The draft statement in evaluating the impacts of the chlorine, recognizes the adverse effects on aquatic biota. The applicant cites Dr. William Brungs, Director of Technical Assistance at EPA's Environmental Research Laboratory at Duluth, Minnesota and the National Academies of Science and Engineering for chlorine discharge criteria. The limits given by the above sources, respectively, are .2 ppm for two-hours per day and .05 ppm for a 30-minute period. Based on a review of the pertinent literature on chlorination impacts by Dr. Brungs, it is our position that limiting exposure to a maximum of two-hours and a concentration of 0.2 ppm is necessary for the protection of warm water fish. More recent assessments, by Jack Mattice of Oak Ridge National Laboratory (ORNL) suggest that the "safe" concentration for a two-hour exposure is more on the order of 0.1 ppm.

The discussion in this draft statement does not address either the State or the Federal regulations. Furthermore, the Wisconsin Department of Natural Resources NPDES permit issued for this facility sets a limit on total chlorine residual of 0.2 ppm and requires Dairyland Power Cooperative to monitor their discharges daily for chlorine. The discussion should include an analysis of the measured values found in the discharge and of the environmental impact if the limitations are met rather than dealing with hypothetical concentrations after mixing. Additional determinations of environmental effects of chlorination by-products are published in the proceedings of a conference on the environmental impact of water chlorination held at ORNL on October 22-24, 1975. Some of the topics raised at this conference may be pertinent to the assessment of the Genoa site, in view of its proximity to shallow reproductive areas. EPA recommends that alternative methods of chlorination or wastewater treatment be evaluated in order to meet State water quality discharge standards for chlorine.

In regard to the reduction of residual chlorine, we believe the sulfite concentration of 5 ppm to be high for river water with normal dissolved oxygen and no gross industrial input. In view of this, the statement in section 5.2.1 that free chlorine will be rapidly reduced by sulfite is questionable.

The Genoa 1 ashpit discharge should be monitored rather than relying on estimates based on the Genoa 3 ashpit. Several parameters should be included in this survey in addition to those reported in Table 5.2-1 for Genoa 3. Alkalinity is important as a measure of the ability to neutralize acid waste discharges and of the likelihood that metals will be precipitated. If the alkalinity is too low, unacceptable quantities of trace elments from the ashpit can enter the river. Arsenic, fluoride, lead, mercury and phosphorus levels should also be monitored since these have been shown to be present at significant concentrations in other ashpits.

INTAKE STRUCTURE

Section 316(b) of the FWPCA requires that "the location, design, construction and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impacts." The discussion of the intake system and structure should be substantially expanded to reflect more of the information available (including screen design and actual measurement data) to justify the staff's conclusions. The 316(b) document prepared by Wapora, Inc. for the LACBWR contains results of intake studies which should be analyzed in the final statement.

The Wapora document indicates that the three species suffering highest rates of impingement are freshwater drum, bluegill, and white crappie. Since this species distribution is unusual when compared to other impingement data for plants on the Mississippi, this discrepancy should be clarified.

The mortality estimates for impinged fish appear to have been derived from studies of the Genoa 3 intake. If this is the case, application of the results to the LACBWR intake should be justified.

It should also be determined whether a simple, immediate, "swim/no-swim" test for viability is sufficient to determine ultimate mortality rates. Fish succumbing to infection of wounds caused by impingement are not included in such studies.

According to the 316(b) document, numbers of impinged fish increase dramatically in the late fall and winter months. An explanation for this finding should be sought in terms of unusual environmental conditions or plant operating procedures.

Discharge of debris from the intake screen washing operation should be examined since any such discharge is prohibited by the State permit.

RADIOLOGICAL ASPECTS

RADIOACTIVE WASTE TREATMENT

LIQUID WASTE TREATMENT

Section 3.6.2.3, Liquid Waste Summary, estimates the release of radioactive materials in liquid waste effluent to be approximately 0.21 Ci/yr, excluding tritium and dissolved gases, and the release of tritium to be approximately 90 Ci/yr. Reported releases of these two categories of waste, and the quantity of waste released, are summarized below for the years 1970 through 1975.

	DES*	1970	1971	1972	1973	1974	1975
Corrosion Products & Mixed Fission Products	0.21	6.46	17.1	48.5	35.9	13.1*	14.1
Tritium	90	19.8	91.4	120	103	115*	127
Gal/yr	8.73+5	6.34+5	NA	8.72+5	6.50+5	4.83+5	5.78+5

NA - not available
* Draft Environmental Statement

It is then stated that the reason that the actual discharges are higher than those estimated by the staff is the licensee's "under-utilization of the installed processing facilities." According to Figure 3.6-1, Liquid Waste Treatment System, these installed processing facilities consist of a 1 gpm evaporator in series with a polishing demineralizer. Since treatment with the installed equipment will not have much effect on the release of tritium, the EPA believes actual releases will probably average 115 Ci/yr (approximately the average of the last four years) rather than 90 Ci/yr. It is recommended that the final statement be so revised. Also, the reduction in the release of corrosion products and mixed fission products, exclusive of dissolved gases, (CP & MFP), seems predicated on the assumption that the liquid waste treatment system as shown in Figure 3.6-1 is capable of processing all wastes prior to discharge. Using the value of 872,790 gal/yr of liquid waste discharged from the liquid radwaste system given in Figure 3.4-2, River Water Use, as the quantity of liquid waste processed annually by the system, it becomes apparent that on a continuous mode basis, this 1 gpm system would have to be able to process waste at a rate beyond its capability, 1.7 gpm to achieve the releases predicted in the draft statement. It is recommended that the section be revised to indicate a higher estimate of CP & MFP release or the modifications, along with the cost benefit analysis, which will be required of the system.

In sections 3.6.2.1 and 3.6.2.2 of the draft statement, it is stated that approximately 1100 gpd of waste will be collected in the containment building collection subsystem and 700 gpd in the turbine building collection system, Figure 3.4-2 indicates a daily release of 2390 gpd; the additional 590 gpd should be identified as to its source in Figure 3.6-1, Liquid Waste Treatment System.

It is our understanding that the present system will soon be modified by the replacement of the evaporator with one of four filtration systems currently being evaluated by the licensee. It is important that the final statement be revised to reflect this modification with respect to the system decontamination factors given in Table 3.6-1; the annual release of the individual isotopes given in Table 3.6-2, and the individual doses which will result from the discharge of liquid radioactive material, currently not given.

GASEOUS WASTE SYSTEM

Table 3.6-3, Calculated Releases of Radioactive Materials in Gaseous Effluents from LaCrosse Boiling Water Reactor, gives a value of 9.5 Ci/yr of the release of Carbon-14. Based on the equation for C-14 on page 2-43 of NUREG-0016, Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors (BWR-GALE Code), April 1976, the annual release from LaCrosse should be on the order of 0.7 Ci/yr. This estimate is based on information given on page 3-8 of the Applicant's Environmental Report which results in a calculated mass of water of 2780 kg in the core region of the reactor. Also, note "a" to this table which includes C-14 is not used in reference to C-14.

In the same table estimated stack releases of 1.0 Ci/yr for I-131 and 2.5 Ci/yr for I-133 are given. These releases include a 3-day holdup and the resultant radioactive decay for the condenser air ejector releases. For I-133, this implies an annual release, without any holdup, of 4.6 Ci/yr. For I-131, because of its longer halflife, the annual release without the 3-day holdup would be approximately 1.1 Ci/yr. The actual releases of these two isotopes have been significantly less than this. The reported releases of I-131 and I-133 are given below:

	DES	1969	1970	1971	1972	1973	1974	1975
I-131	1.0	ND	ND	ND	0.66	.18	.03	.08
I-133	2.5	ND	ND	ND	ND	ND	.02	.03

ND - Not detectable

*The stated licenses in Section 3.6.7.3 of 12.7 Ci and 74 Ci are incorrect. See pg. 54, NUREG-0077, "Radioactive Materials Released From Nuclear Power Plants 1974," June 1976.

It is apparent that the releases of these two isotopes from this source, as estimated by the GALE Code, are significantly higher than the releases reported by the licensee. The difference does not appear to be attributable to less than full power operation since the thermal capacity factors

for 1974 and 1975 are 0.75 and 0.65 compared to the 0.80 used in the draft statement. Considering that several years of operating data are available for LaCrosse, it would seem reasonable to make use of this data, at least in comparison with the theoretical code results in determining the annual releases.

The estimated noble gas releases appear to be consistent with continuous operation of the recombiner and the waste gas storage tanks, although insufficient information is given to determine the practicability of requiring continuous operation of this system. No evaluation of the estimates of the remaining radionuclides was made since no data exist in the LaCrosse operating reports on their actual release rates.

SOLID WASTE SYSTEM

The EPA agrees with NRC's conclusion that the past performance of this system has proven its general acceptability.

DOSE ASSESSMENT

INDIVIDUAL DOSES

The draft statement does not adequately reflect the impact of the LaCrosse Boiling Water Reactor in that it makes no estimates of the radiological doses to representative individuals in the surrounding area. Although the NRC will require that the plant be operated in accordance with Appendix I to 10 CFR 50, which places an upper limit on the dose, this does not represent an assessment of the expected doses to the individual receiving maximum exposure.

We have not attempted to calculate the doses from all the pathways that maximally exposed individuals could expect to receive because of (1) the inaccurate evaluation of the capability of the liquid waste system to reduce liquid effluents to the levels indicated in Table 3.6-2; and (2) the over estimation of the iodine releases coupled with the lack of meteorological data, and of specific receptor location and X/Q data.

The lack of appropriate X/Q values in both the statement and the Environmental Report make it impossible to accurately evaluate the projected 1 Ci/yr release of Iodine 131 with respect to the potential maximum individual infant thyroid dose via the cow-milk-infant pathway. An estimation of this dose can be made by comparing the projected 1 Ci/yr I-131 release to the releases during the first seven months of 1972. During this period, approximately 0.19 Ci of I-131 was released resulting in a calculated average monthly dose of 28.2 mrem.

On an annual basis, this would be .33 Ci of I-131 resulting in 338 mrem/yr, as statyed on page 5-32 of the Environmental Report. Normalizing to 1 Ci/yr and 5-months/year of grazing results in an annual dose of 427 mrem to an infant's thyroid.

If one calculates the average individual dose, using the X/Q given on page 5-31 of the Environmental Report (6.96×10^{6} sec/m^3), a dose conversion factor of 1700 mrem/yr per pCi/m in air, and the projected 1 Ci/year, the result is an annual dose of 156 mrem. Using a dose conversion factor of 4000 mrem/yr per pCi/m in air for the maximum individual, gives an annual dose of 366 mrem.

Obviously these doses are unacceptable. The problem seems to lie, both in the quantity of I-131 estimated as a maximum annual release and with the X/Q given in the draft statement. This X/Q of 6.96×10^{6} sec/m^3 is stated as being for a ground level release, whereas the actual release is through a 350 foot stack. However, there is a 600 foot bluff approximately 2000 feet east of the stack. It is atop this bluff that the dairy cows are located. In the licensee's milk sampling program for the last 3-years, they have found no detectable I-131 at a minimum detection level of 1 pCi/liter. The discrepancy between the actual and calculated levels of I-131 should be resolved.

It appears that a more detailed assessment of the local meteorology should be included in the final statement with an assessment of the individual doses.

If the final cow-milk-infant-thyroid doses based on re-evaluation of the I-131 and I-133 releases are still above the Appendix I limit, the final statement should discuss additional iodine treatment necessary to insure conformance to Appendix I.

POPULATION DOSE COMMITMENTS

We are encouraged that the NRC is now calculating annual population dose commitments to the U. S. population which is a partial evaluation of the total potential environmental dose commitments (EDC) of H-3, Kr-85, C-14, iodines and "particulates." This is a big step toward evaluating the EDC, which we have urged for several years. However, it should be recognized that several of these radionuclides (particularly C-14 and Kr-85) will contribute to long-term population dose impacts on a world-wide basis, rather than just in the United States. To the extent that the draft statement (1) has limited the EDC to the annual discharge of these radionuclides, (2) is based on the assumption of a population of constant size, and (3) assesses the doses delivered during 50-years only following each release, it does

not fully address the total environmental impact. Assessment of the total impact would (1) incorporate the projected releases over the lifetime of the facility (rather than just the annual release), (2) extend to several half-lives or 100-years, beyond the period of release, and (3) consider, at least qualitatively or generically, the world-wide impacts. Thus, we request that future assessments recognize these influences on the total environmental impact or specify the limitations of the model used.

We feel that a comparison should be made between the population dose commitments with and without the mandatory use of the liquid and gaseous waste processing systems (as indicated in the draft statement) in order to evaluate the practicability of their continuous operation.

In section 5.5.1.1, Dose from Radioactive Releases to the Atmosphere, the following sentence appears: "Indirect food pathways were based upon the assumption that meat, milk, and crop productivity of the land east of the Mississippi River is capable of supporting the U. S. population." The final statement should explain the consequences of this assumption and their bases.

DIRECT RADIATION

The 3.4 mrem/yr from direct radiation and the 14 mrem/yr from N-16 skyshine as given in the Braun SAR Amendment 4, page 12.1-5b dated June 27, 1975, (reference 24 shows p. 12.1-56), is based on 100% occupancy at a distance of 2112 feet (0.4 miles). A recent study (Ref. 4) at a 2400 MWth BWR by the EPA and the Energy Research and Development Administration (ERDA) shows that at a distance of 1640 feet (0.31 miles), the direct radiation is negligible and the N-16 skyshine dose is on the order of 10 mrem/yr. Measurements made at the plant on April 25-26, 1972, while at 50 MWe, resulted in an estimated gamma dose, from all sources, of 10 mR/yr at 1109 feet (.21 miles). The average off-gas release rate at this time was only 631 Ci/sec. (Ref. 5). Using an occupancy factor of 0.5, the annual dose to a real individual would be approximately 5 mrem/yr. For a plant which has operated for over nine-years and where actual measurements have been performed, it seems reasonable that this information should be used to accurately and correctly represent the plant.

Similarly, with respect to occupational radiation exposure, using estimates developed for current generation BWR's does not seem resonable when the LACBWR monthly operating reports provide occupational doses for six categories of personnel and eight ranges

of exposure rates. We feel very strongly that for LACBWR, existing data must be used to properly assess the environmental impact of the facility; otherwise, the considerable effort expended by the licensee to accumulate and report such data is wasted. Although we have not made a specific effort to accumulate this data, we do have some of it. An analysis of 27-months of data during the years 1973, 1974 and 1974, indicates an average annual total exposure to plant personnel of approximately 140 man rem. For contractor personnel and visitors, the average annual exposure has been approximately 18 man rems.

REACTOR ACCIDENTS

The EPA has examined the NRC's analyses of accidents and their potential risks. The analyses were developed by NRC in the course of its engineering evaluation of reactor safety in the design of nuclear plants. Since these issues are common to all nuclear plants of a given type, EPA concurs with NRC's generic approach to accident evaluation. The NRC is expected to continue the efforts initiated by AEC to insure safety through plant design and accident analyses in the licensing process on a case-by-case basis.

In 1972, the AEC initiated an effort to examine reactor safety and the resultant environmental consequences and risks on a more quantitative basis. The EPA continues to support this effort. On August 20, 1974, the AEC issued for public comment, the draft Reactor Safety Study (WASH-1400), which was the product of an extensive effort to quantify the risks associated with light-water-cooled nuclear power plants. The EPA's review of this document included in-house and contractual efforts, and culminated in the release of final Agency comments on the draft report on August 14, 1975. Initial comments were issued on November 27, 1974.

EPA completed its review of the final Reactor Safety Study on June 11, 1976, and issued a public report of its findings. In general, our previous conclusions on WASH-1400 are still valid. We identified apparent errors, omissions and questionable assumptions regarding health effects analyses, emergency remedial measures and failure analysis which would generally increase the calculated probabilities or consequences and, thus, the risks. We are working with NRC to resolve these points so that a consensus may be attained regarding the validity of the risk estimates given in WASH-1400. A generic analysis of the acceptability of the present risks or whether increased levels of safety are necessary has not yet been made. In the meantime, we have identified no reason serious enough to call for an immediate restriction in the application of nuclear power.

FUEL CYCLE and LONG-TERM DOSE ASSESSMENTS

EPA is responsible for establishing generally applicable environmental radiation protection standards to limit unnecessary radiation exposures and radioactive materials in the general environment resulting from normal operations of facilities that are part of the uranium fuel cycle. EPA has concluded that environmental radiation standards for nuclear power industry operations should take into account the total radiation dose to population, the maximum individual dose, the risk of health effects attributable to these doses (including the future risks arising from the release of long-lived radionuclides to the environment), and the effectiveness and costs of effluent control technology. EPA has proposed standards which are expressed in terms of individual dose limits to members of the general public and limits on quantities of certain long-lived radioactive materials in the general environment.

A document entitled "Environmental Survey of the Uranium Fuel Cycle" (WASH-1248) was issued by AEC in conjunction with a regulation (10 CFR 50, Appendix D; now 10 CFR 51) for application in completing the cost-benefit analysis for individual light-water reactor environmental reviews (30 F.R. 14188). This document has been used by NRC in draft environmental statements to assess the incremental environmental impacts attributed to fuel cycle components which support nuclear power plants. As suggested in our comments on the proposed rulemaking (January 19, 1973), if this approach were to be used for future plants, it would be important for NRC to periodically review and update the information and assessment techniques used. We believe that the following points should be considered any such update efforts:

The commitment of land and resources for ultimate waste disposal;

The economic and resource commitments to future generations, including societal and institutional commitment; and

The economic, resource, and energy costs of ultimate waste disposal as balanced against the short-term benefits realized by energy production.

In response to a recent court decision, the NRC has prepared a report (to be publicly released in October 1976) concerning the ultimate disposal of nuclear wastes. We understand that the NRC will initiate an interim rulemaking and then will schedule hearings in early 1977 to obtain public input to modify their generic fuel cycle impact analyses (which are included in individual nuclear power plant impact statements). We recommend that the general points we have itemized above be considered in the rulemaking hearings.

HIGH-LEVEL WASTE MANAGEMENT

The techniques and procedures used to manage high-level radioactive wastes will have an impact on the environment. To a certain extent, these impacts can be directly related to individual projects because the reprocessing of spent fuel from each new facility will contribute to the total waste. The AEC, on September 10, 1974, issued for comment a draft statement entitled, "The Management of Commercial High-Level and Transuranium-Contaminated Radioactive Waste" (WASH-1539). In this regard, EPA provided extensive comments on WASH-1539 on November 21, 1974. Our major criticism was that the draft statement lacked a program for arriving at a satisfactory method of "ultimate" high-level waste disposal. At present, ERDA intends to prepare a new draft statement which will discuss waste management and emphasize ultimate disposal in a more comprehensive manner. EPA concurs with this decision and will review and comment on the new draft statement when it is available.

Because of a recent court decision regarding the issue of ultimate disposal of radioactive wastes, the NRC has concluded that no new full-power operating license, construction permit, or limited work authorization should be issued pending resolution of the issue. The NRC is preparing a revised environmental survey on the probable contribution to the environmental costs of licensing a nuclear power reactor that is attributable to the reprocessing and waste management stages of the uranium fuel cycle.

EPA is cooperating with both NRC and ERDA to develop an environmentally acceptable program for radioactive waste management. In this regard, EPA will establish environmental radiation protection criteria for radioactive waste management in 1977 and environmental radiation protection standards for high-level waste in 1978. We have concluded that the continued development of the Nation's nuclear power industry is acceptable from an environmental stand point during the period required to satisfactorily resolve the waste management question.

TRANSPORTATION

In its earlier reviews of the environmental impacts of transportation of radioactive material, EPA agreed with AEC that many aspects of this program could best be treated on a genreic basis. The NRC has codified this generic approach (40 F.R. 1005) by adding a table to its regulations (10 CFR Part 51) which summarizes the environmental impacts resulting from the transportation of radioactive materials to and from light-water reactors. This regulation permits the use of the impact values listed in the table in lieu of assessing the transportation impact for individual ractor licensing actions if certain conditions are met. Since LaCrosse appears to meet these conditions and since EPA agrees that the transportation impact values in the table are reasonable, the generic approach appears adequate for this plant.

The impact value for routine transportation of radioactive materials has been set at a level which covers 90 percent of the reactors currently operating or under construction. The basis for the impact, or risk, of transportation accidents is not as clearly defined. At present, EPA, ERDA, and NRC are each attempting to more fully assess the radiological impact of transportation risks. The EPA will make known its views on any environmentally unacceptable conditions related to transportation. On the basis of present information, EPA believes that there is no undue risk of transportation accidents associated with LaCrosse.

ADDITIONAL COMMENTS

1. It is indicated all fuels and lubricants will be stored in accordance with applicable local laws. Attention to applicable Federal and State laws regarding spill prevention planning (SPCC Plans) should also be required.

2. There is no mention of the elevation of the reactor facility above the river. There should be some discussion of the likelihood of flooding due to failure of a dam or any other cause, and what the consequences would be in terms of the integrity of the site.

3. The use of any materials containing PCB's should be indicated in the statement. The eventual disposal of these materials and the control methods used to prevent PCB's from entering the food chain should be discussed.

REFERENCES

1. Brungs, W.S., "Effects of Residual Chlorine on Aquatic Life," J. Water Pollution Control Federation, 45:2180-2193, 1973.

2. Mattice, J.S. 1976. A method for estimating the toxicity of chlorinated discharges. Presented at Workshop on Impact of Power Plants on Aquatic Systems, Pacific Grove, California, sponsored by Electric Power Research Institute. Sept. 28-Oct. 2, 1975. 12 p. In press.

Mattice, J. S., and H. A. Pfuderer. 1976. Chemistry and effects of chlorine in aquatic systems: an annotated bibliography. ORNL/EIS-82. Oak Ridge National Laboratory, Oak Ridge, Tenn. 69 pp.

Mattice, J. S., and H. E. Zittel. 1976. Site specific evaluation of power plant chlorination: a proposal. J. Water Pollution Control Federation. In press.

3. Jolley, R. L., editor, Proceedings of the Conference on the Environmental Impact of Water Chlorination, Oak Ridge National Laboratory, July 1976, NTIS: CONF-751096.

4. Phillips, C., Lowder, W., Nelson, C., Widham, S., and Partridge, J., Nitrogen-16 Skyshine Survey at 2400 MW(t) Power Plant, EPA-520/5-75-018.

5. Environmental Report Supplement for LaCrosse Boiling Water Reactor, Dairyland Power Cooperative, DPC-ED-3, June 15, 1973. Docket 50-409.

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

50-409

SEP 8 1976

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety
and Environmental Analysis
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Knighton:

This is in response to your transmittal dated June 25, 1976, inviting the U.S. Energy Research and Development Administration (ERDA) to review and comment on the Nuclear Regulatory Commission's draft environmental related to the operation of the La Crosse Boiling Water Reactor.

We have reviewed the draft statement and have determined that the proposed action will not conflict with current or known future ERDA programs. However, enclosed are ERDA staff comments which you may wish to consider in the preparation of the final statement.

Thank you for the opportunity to review this statement.

Sincerely,

W. H. Pennington, Director
Office of NEPA Coordination

Enclosure:
ERDA Staff Comments

cc w/enclosure:
CEQ (5)

9341

ERDA STAFF COMMENTS
ON THE
NUCLEAR REGULATORY COMMISSION'S DES
RELATED TO THE OPERATION OF THE
LA CROSSE BOILING WATER REACTOR
NUREG-0086

1. Page 3-8, Item 3.6 - Radioactive Waste Systems

This section addresses the types of radioactive liquid and gaseous effluents expected from the LACBWR. In section 3.6.2, Liquid Waste System, the report notes that radiation detectors in the waste discharge line activate a high radioactivity alarm for activity levels which exceed predetermined values. The statement does not address the recapture of the liquid waste before it is released into the Mississippi River, in the event that the high radioactivity alarm is activated. It appears that if the alarm is activated through the waste discharge line, what is only known is that excessive radiation (or radioactive material) has been discharged into the river. We suggest that this point might be expanded.

2. The subject report does not speak of the measurement methods used to measure either liquid or gaseous effluents. We suggest that the statement include some discussion to identify how they will handle the subject.

3. Page 3-16, Item 3.6.4 - Solid Waste System

The measurements of solid wastes generated within the plant should be identified as to how the LACBWR will determine the content of solid waste removed from the facility.

4. Page 10-2, Item 10.2.3 - Decommissioning and Land Use

With the life of the LACBWR being identified at 30 years, the problem of decommissioning (and decontamination) is a problem and the draft NRC report does not speak to the question of who pays for the decommissioning of the facility. If the facility is placed in "mothball" status, it will still require perpetual, continual surveillance for security and containment effectiveness. The question of decommissioning costs might be more fully addressed in the statement to present a better discussion on the subject.

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July 9, 1976

George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and Environmental Analysis
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Knighton:

We have received the Draft Environmental Statement related to the operation of the La Crosse Boiling Water Reactor Dairyland Power Cooperative Docket Number 50-409, published June 1976.

We do not have the technical capability to comment upon the aspects of the plant or its environmental effects, but we do have knowledge of demographic data, plans of other agencies, and general local and regional planning efforts.

On Page 2-6 we note reference is made to the Mississippi River Regional Planning Commission (MRRPC) assistance to Vernon County in developing a comprehensive zoning ordinance. The County has now adopted this ordinance however, as per Wisconsin Statutes, it is not effective in any Town until it is ratified by the Town Board. The Genoa Town Board has not yet ratified this ordinance, and shows no apparent inclination to ratify it in the immediate future. The county-wide flood plain zoning ordinance is in effect, in the rural Town and the Village of Genoa has a flood plain ordinance within the Village limits. There is no general zoning ordinance in the Village.

On Page 2-7 under Section 2.2.4-Recreation two highway waysides are mentioned. A third facility, the State Department of Transportation Division of Highways Scenic Overlook, three miles north of LACBWR on Highway 35, should also be added.

Our Commission has, at the request of Crawford County, studied volunteer fire departments in that County. We have not examined the Genoa Fire Department but presumedly many of the same findings would apply. These are rural volunteer departments, have virtually no training or expertise in "exotic" type fires involving chemicals, etc. A fire at the nuclear power plant would probably be beyond the training level of the Genoa Fire Department, unless they've received training we are unaware of. We would urge that special instructions be given by LACBWR personnel to the Genoa Fire Department regarding fires or other emergencies at that installation.

MRRPC population projections for selected incorporated communities within the 25-mile radius of the LACBWR are enclosed.

Continued . . . .

7074

George W. Knighton Letter
Page 2
July 9, 1976

We have notified the Biology Department at the University of Wisconsin-La Crosse of the release of the Draft Environmental Statement. As they review the document additional comments on environmental matters may arise.

Thank you for the opportunity to review and comment upon this Draft Environmental Statement.

Sincerely,

Robert G. Fisher

Robert G. Fisher
Planning Analyst

RGF:las

cc: Tom Steele, Dairyland Power
Chester Erlandson, Vernon County

Enc.

INCORPORATED AREA	PROJECTED POPULATION RANGE 1980	1985	1990	DISTANCE FROM LACBWR (MILES)
Genoa - Vernon County	298 - 307	291 - 308	285 - 309	1
Stoddard - Vernon County	925 - 935	1017 - 1030	1100 - 1025	6.5
Chaseburg - Vernon County	250 - 272	252 - 297	257 - 322	9
De Soto - Vernon/Crawford County	260 - 265	232 - 250	210 - 235	10
Coon Valley - Vernon County	705 - 732	745 - 800	790 - 870	16
Ferryville - Crawford County	179 - 213	193 - 228	197 - 242	17
Viroqua - Vernon County	3532 -3590	3430 - 3520	3330 - 3435	18
Gays Mills - Crawford County	619 - 632	615 - 637	612 - 642	20
Westby - Vernon County	1710 -1800	1748 - 1918	1800 - 2035	20
Mt. Sterling - Crawford County	163 - 177	153 - 170	143 - 171	22
Lynxville - Crawford County	119 - 132	107 - 123	99 - 116	23
Readstown - Vernon County	338 - 348	302 - 325	270 - 300	24
Soldiers Grove - Crawford County	462 - 540	402 - 555	363 - 570	25
West Salem - La Crosse County	2600 -2630	2810 - 2875	3050 - 3110	25

Note: Population projections computed by Mississippi River Regional Planning Commission based on 1975 estimates, using "least squares" and "straight line projection" as the bounds.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S. Earl
Secretary

BOX 450
MADISON, WISCONSIN 53701

October 1, 1976

IN REPLY REFER TO: 1600

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety &
Environmental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

RECEIVED
OCT 4 1976
U.S. NUCLEAR REGULATORY COMMISSION
Mail Section

50-409

Dear Mr. Knighton:

Re: Draft Environmental Statement Related to Operation of the La Crosse Boiling Water Reactor (LACBWR), Dairyland Power Cooperative, Vernon County, Wisconsin

We have completed our review of the subject document and offer these comments.

Specific Comments

Section 2 - The locations of hospitals in the area, their accessibility from the LACBWR and their existing and projected capacities should be indicated.

Section 3.4.5, paragraph 4 - What is the location of the disposal site? Do these wastes contain radioactive and toxic materials?

Section 3.5.2, paragraph 3 - Who conducted the "recent study" referred to?

Section 3.6.2, paragraph 1 - What are the "predetermined values" of radioactivity? The following information should be provided in this section:

1. The level of radioactivity that can be released directly into the river.

2. The level of radioactivity that can be released to the river under controlled conditions.

10006

3. The level of radioactivity that must be retained for processing.

Section 3.6.2.1, 3.6.2.2 and 3.6.2.3 - It is not clear why the N.R.C. staff had to "assume" that liquid wastes are processed through an evaporator and polishing demineralizer and why these facilities have been under-utilized.

Section 3.6.2.2 - Is the decay time of 0 days the intended figure?

Section 3.6.2.3 - What assurance is there that Dairyland Power Cooperative would operate its processing facilities in such a manner as to reduce the radioactive liquid release, excluding tritium and dissolved gases, down from the 1974 level of 12.7 Ci to the calculated level of 0.21 Ci/year? Is the 1974 level in excess of the requirements of the Environmental Technical Specifications? What is the "Appendix I" which is referred to? Perhaps it should be included as an appendix to the final environmental statement.

Section 3.6.3.4 - The applicant's discharge of 53,000 Ci of noble gases in 1974 was approximately 5.3 times greater than the calculated amount. The above comments concerning Section 3.6.2.3 also apply here. The half-lives of the radionuclides included in Table 3.6-3 should be indicated.

Section 3.6.4 - The location and projected lifetime of the burial facility should be indicated. Are all waste materials being shipped to the disposal site or is there some on-site storage? Is there a plan to increase storage and, if so, where?

Section 3.7.2 - Where are the employees clothes washed and what system does the wash water enter?

Section 3 - This section should contain a brief discussion of the security measures in effect at the plant.

Section 4.1, paragraph 1 - We disagree with the conclusion that the filling in of 26.8 acres of lowland was a temporary impact. Paragraph 2 - Construction of a boat launching facility and a parking lot hardly compensates for the loss of nearly 27 acres of river and adjacent marshland. A wording change would be appropriate.

Section 4.2, paragraph 1 - It appears that the "two wrongs make a right" theory is being employed to rationalize away the impact of plant construction on the river. Incidentally, the State of Wisconsin is actively seeking changes in the Corps of Engineers' traditional dredge spoiling practices which presently have substantial adverse effects.

Section 4.3.2 - The loss of spawning and nursery areas resulting from the filling of 27 acres should be discussed.

Section 5.2.2 - Has any monitoring been done to determine if plant operations (including the ashpit) have affected groundwater quantity or quality in nearby wells? It appears that the conclusions offered in this section are based on conjecture.

Section 5.3.1, paragraph 2 - The maximum recorded temperature increases of 56 degrees F for the Genoa 3 plant and 42 degrees F for LACBWR are extremely large. What measures would be employed to insure that changes of this magnitude would be avoided in the future? What are the "appropriate upper limits" which will be included in the Environmental Technical Specifications?

Paragraph 8 - The implications of the incomplete mixing during November (and probably the rest of the winter months) should be discussed.

Section 5.3.2, paragraph 3 - Why is mixing assumed to be complete when the study by T. O. Claflin indicated that it was incomplete in November?

Table 5.5-1 - Are the estimates of radiation exposure based on calculated emission levels or on the higher existing levels which have resulted from under-utilization of the processing facilities?

Section 5.5.1.4, paragraph 1 - If the reason for the observed fluctuations in the dose rates around the plants is known it should be indicated.

Paragraph 5 - How low is "as low as is reasonably achievable"?

Paragraph 7 - Occupational exposure is expected to be 500 man-rem per year. According to footnote "b" in Table 5.5-3, occupational exposure should be limited to 5,000 millirems/year. Clarification of the relationship between these two figures should be provided.

Although pre-operational sampling of radiation levels in air, water, soil, vegetation and animals at the plant site was conducted and the results described in Section 2.8.1, no similar post-operational study appears to have been done. It would seem that post-operational sampling would be appropriate.

Section 5.6.2, paragraph 8 - While only about 2.5 percent of the 7-day, 10-year low flow of the river passes through LACBWR, it does not necessarily follow that no more or less than 2.5 percent of the river's entrainable biota will be killed. In the absence of distribution studies it is not safe to assume that the biota is evenly distributed throughout the river. It is possible that the mortality figure could be more or less significant than the percentage indicated by river flow.

Paragraph 9 - A brief description of the "variations in current velocity and sediment type" at the transects should be included as they could have a considerable influence on the results of the aquatic invertebrate sampling.

Paragraph 12 - Commercial fishing data from 1971 to the present should be included to support the conclusion that there has been no widespread or long-term damage.

Paragraph 13 - The threat of cold shock to fish does not depend entirely upon a plant shutdown; fish could move in and out of the heated water on their own. In addition, what would be the impact of a simultaneous shutdown of both the LACBWR and Genoa 3?

More discussion should be provided on the following concerns:

1. Does the thermal plume act as a barrier to natural fish migration?

2. Will the heated effluent induce the early spawning of fish in the mixing zone under conditions unfavorable to survival?

3. What are the effects of temperature changes on the early developmental stages of fish?

4. What has been the effect of the barge traffic in Thief Slough on aquatic organisms and fishermen?

Section 5.7.1 - The Department has received complaints from both commercial and sport fishermen to the effect that the open water and thin ice created by the thermal discharge has hindered use of the area during the winter months.

Section 7 - Although the probability of a major accident may be negligible, we believe that the consequences of such an occurrence should be examined, at least briefly. While a detailed description of plant security may be inappropriate, there should be at least some indication that it exists. The discussion of transportation-related accidents should be site-specific rather than the generalization provided.

Section 10.3.3 - The discussion of the availability and costs of uranium fuel in the next 30 years should be expanded. We understand that the uranium supply situation in the United States may deteriorate badly in the above time period.

Section 10.3.4 - The first paragraph is overly expansive. The air and water resources do not have an infinite assimilative capacity. There are no doubt limits to the amount of wastes these resources can tolerate before suffering irreversible damage.

General Comments

We were unable to find any discussion in this environmental statement regarding the amount of "down-time" that has occurred during the years of operation of this plant. We believe that the amount of down-time has been quite substantial. Presumably, this fact would constitute an important element to be considered in the overall analysis and evaluation of the benefit-cost balance of the plant both from an economic and from an environmental standpoint.

We appreciate the opportunity to review and comment on this draft environmental statement and hope that our concerns will be considered in the preparation of the final environmental statement. We would appreciate receiving four copies of the final document when it is completed.

Sincerely,
Bureau of Environmental Impact

James R. Huntoon

James R. Huntoon
Director

STATE OF WISCONSIN

Patrick J. Lucey
Governor

DEPARTMENT OF ADMINISTRATION
One West Wilson Street • Madison, Wisconsin 53702

Robert H. Dunn
Secretary

Regulatory Docket File

RECEIVED OCT 29 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

OCT 29 1976

September 23, 1976

Mr. Fred Hebdon, NRC Environmental
Project Manager
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

RE: Draft Environmental Impact Statement related to the operation of the LaCrosse Boiling Water Reactor, Dairyland Power Cooperative, Docket No. 50-409.

Dear Mr. Hebdon:

As per our telephone converstion, this letter is to confirm that the State Planning Office has no comments at this time on the Draft Environmental Impact Statement on the LaCrosse Boiling Water Reactor. I have checked with other agencies and found the following. The Wisconsin Department of Natural Resources does have comments and has contacted you concerning them. There will be no comments at this time from the Office of Emergency Energy Assistance nor from the Public Service Commission.

If our office can be of further assistance, please feel free to contact us.

Sincerely,

Caryl E. Terrell, State Coordinator
Wisconsin Environmental Policy Act
Office of State Planning and Energy

CET:my

10965

THE STATE HISTORICAL SOCIETY OF WISCONSIN

916 STATE STREET / MADISON, WISCONSIN 53706 / JAMES MORTON SMITH, DIRECTOR

State Historic Preservation Office

July 28, 1976

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Site Safety and Environmental
Analysis
United States Nuclear Regulatory Commission
Washington, D. C. 20555

SHSW 413-76

Dear Mr. Knighton:

Reference your June 25, 1976 letter concerning Cite Docket No. 50-409 regarding Notice of Availability of Draft Environmental Statement for the La Crosse Boiling Water Reactor in Vernon County, Wisconsin.

There are no sites listed on the National Register of Historic Places that would be adversely affected by this project. Furthermore, there are no sites known to us of archeological, architectural, or historical significance in the project area that would be eligible for inclusion on the National Register of Historic Places.

We are informing the local historical society of this project and should they inform us of a site or building in the project area that we are unaware of, we will contact you immediately.

Sincerely,

Richard A. Erney
Acting State Historic Preservation
Officer

RAE:rdd

cc: Mrs. Jason Hornby, President
Vernon County Historical Society

7800

STATE OF IOWA

Office for Planning and Programming

523 East 12th Street, Des Moines, Iowa 50319 Telephone 515/281-3711

ROBERT D. RAY
Governor
ROBERT F. TYSON
Director

August 30, 1976

Director, Division of Sight, Safety
and Environmental Analysis
Office of Nuclear Reactor Regulation
U.S. Nucleator Regulatory Commission
Washington, D.C. 205555

SAI: 761524
750116
Dairyland Power Cooperative
LaCrosse, Wisconsin

Dear Sir:

The Iowa State Clearinghouse has completed its review of the two above numbered projects on the Dairyland Power Cooperative. The only comments that were generated from these reviews are attached for your information.

We have completed the review of this particular project unless there are additional factors of which we are unaware.

This letter is being sent to you at the request of Mr. Fred Hebron of your office.

Sincerely,

A. Thomas Wallace
A. Thomas Wallace
Federal Funds Coordinator

ATW/wf

Attachment

8828

STATE OF IOWA

Office for Planning and Programming

523 East 12th Street, Des Moines, Iowa 50319 Telephone 515/281-3711

ROBERT D. RAY
Governor
ROBERT F. TYSON
Director

STATE CLEARINGHOUSE

PROJECT NOTIFICATION AND REVIEW SIGNOFF

Date Received: April 8, 1976 State Application Identifier: 761524

Review Completed: May 13, 1976

APPLICANT PROJECT TITLE:
Construct and Modify Transmission Lines, Sub Stations and Other Facilities

APPLICANT AGENCY: Dairyland Power Cooperative
Address Le Crosse Wisconsin 54601
Attention: Thomas A. Steele, Manager

FEDERAL PROGRAM TITLE, AGENCY AND CATALOG NUMBER: Rural Electrification Loans
Department of Agriculture
Rural Electrification Administration
Catalog No. 10.850

AMOUNT OF FUNDS REQUESTED: Federal Funds - $ 21,112,000
TOTAL FUNDS - $ 21,112,000

PROJECT DESCRIPTION:
The project includes a loan request for transmission facilities, substation facilities, communications and control equipment, load management control equipment, and several buildings for warehousing and maintenance.

The State Clearinghouse makes the following disposition concerning this application:

/__/ No Comment Necessary. The application must be submitted as received by the Clearinghouse with this form attached as evidence that the required review has been performed.

/X/ Comments are Attached. The application must be submitted with this form plus the attached comments as evidence that the required review has been performed.

STATE CLEARINGHOUSE COMMENTS:

CH-14 Rev. 9-75

A. Thomas Wallace
Federal Funds Coordinator

Department of Transportation

PLANNING AND RESEARCH DIVISION

826 LINCOLN WAY AMES IOWA 50010 515 296-1651

REF. NO. 010.05

April 27, 1976

Mr. A. Thomas Wallace, Jr.
Federal Funds Coordinator
Office for Planning and Programming
523 East 12th Street
Des Moines, IA 50319

Dear Mr. Wallace:

Re: PNRS Letter of Intent, Project No. 761524, Transmission line, Howard County.

We have received notice of letter of intent on this project. We have no interest in the project and it is not in conflict with any programs in which the Iowa Department of Transportation is involved at this time.

We thank you for the opportunity of reviewing this submittal.

Very truly yours,

Raymond L. Kassel, Director

RLK:JFC:cb
cc: James F. Cobb
Assistant Program Manager
Office of Program Management
Iowa Department of Transportation

Robert Humphrey
Project Planning Engineer
Office of Project Planning
Iowa Department of Transportation

STATE OF IOWA

Office for Planning and Programming

523 East 12th Street, Des Moines, Iowa 50319 Telephone 515/281-3711

ROBERT D RAY
Governor

ROBERT F. TYSON
Director

STATE CLEARINGHOUSE

PROJECT NOTIFICATION AND REVIEW SIGNOFF

Date Received: June 29, 1976 State Application Identifier: 761524

Review Completed: July 23, 1976

APPLICANT PROJECT TITLE:
Draft Environmental Statement, La Crosse Boiling Water Reactor

APPLICANT AGENCY: United States Nuclear Regulatory Commission
Address Washington D. C. 20555

FEDERAL PROGRAM TITLE, AGENCY AND CATALOG NUMBER: United States Nuclear Regulatory Commission

AMOUNT OF FUNDS REQUESTED: NA

PROJECT DESCRIPTION:
This is a draft environmental statement for the Dairyland Power Cooperative, La Crosse Boiling Water Reactor

The State Clearinghouse makes the following disposition concerning this application:

/X/ No Comment Necessary. The application must be submitted as received by the Clearinghouse with this form attached as evidence that the required review has been performed.

/ / Comments are Attached. The application must be submitted with this form plus the attached comments as evidence that the required review has been performed.

STATE CLEARINGHOUSE COMMENTS:

CH-14 Rev. 9-75

Federal Funds Coordinator

the Kickapoo Scout

SOLDIERS GROVE, WIS. 54655 PHONE 608 624-3792

Sirs:

I am opposed to granting a permanent license to Dairyland Power for their nuclear plant at Genoa. I am opposed to the granting of a permanent license because Dairyland's own figures show that after 1978 the nuclear plant will be generating electricity that isn't needed. Even for its xcess margin requirements see page sec 8-11 Table 8.4-1.

Thank you.

Ralph Lundy

Publisher.

OES Comment
Received OPA
8/18/76
G - 8/18

DAIRYLAND POWER COOPERATIVE

La Crosse, Wisconsin

54601

September 23, 1976

DOCKET NO. 50-409

Mr. George W. Knighton
Environmental Projects
Branch No. 1
Division of Site Safety
and Environmental Analysis
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Re: Letter, Knighton to Madgett, Dated September 15, 1976

Dear Mr. Knighton:

We have examined the load forecast as shown in Table 8.4-1 of the La Crosse Boiling Water Reactor Draft Environmental Impact Statement (DEIS). We find the forecast shown is not the forecast of Dairyland Power as stated in the report. The generating capacity and the adjusted generating capacity in MW_e are not those provided to the NRC in our forecast. Enclosed is a copy of our forecast as previously provided. We think it is important to note the differences between our forecast and the one shown in the DEIS are slight and do not alter the basic pattern. Our own figures while indicating the same basic pattern are consistently lower than those shown in the DEIS (see attached projection).

In our opinion, we believe it was unfortunate that Table 8.4-1 of the DEIS showed only a five-year projection. It gives the reader the impression Dairyland will have an excess reserve margin for the summer of 1979 and succeeding years. As shown in our enclosed reserve margin projection covering ten years, Dairyland Power will be below the minimum 15% reserve margin for the years 1976 through 1978. The projection shows the reserve margin decreasing every winter to the point where Dairyland would have no reserve margin in 1979 if new capacity were not added to the system. During 1979, Dairyland expects to bring on line a new 350 MW_e coal-fired unit to increase the reserve margin above the 15% minimum. Because new units are added in large blocks of capacity for economic reasons, the reserve margin will rise substantially above the required 15% minimum for 1979 and 1980 as shown in our projection. But as demand for electricity increases in succeeding years, we see this excess reserve margin being quickly depleted to the point that by the winter of 1983, Dairyland will again have no reserve and must obtain additional capacity.

9733

This is a typical pattern. It is of concern to us that even with the addition of a new facility in 1979 we will again be needing another increment of generating capacity three years later. Without LACBWR an increment of capacity would have to be added even sooner. Thus, it is Dairyland's position that LACBWR is easily justified when one looks at the projected load growth, the economics, and the age of Dairyland's other units.

Enclosed is the information you requested with the exception of the availability factor which is not recorded by Dairyland's fossil plants and the 1977 estimates which will not be completed until November of this year. Due to delays in the mail service, this response could not be submitted by September 20. If there are any questions concerning this information, please contact us.

Very truly yours,

DAIRYLAND POWER COOPERATIVE

John P. Madgett, General Manager

JPM/cw
Enclosures

	Total kwh	Total Operating and Maintenance *	Total Fuel Cost	Capacity Factor	Years of Service Respectively (197
		1974			
Alma 1,2,3	198,551,000	2,003,442	1,567,001	43,80	29,29,25
Alma 4	334,802,000	2,580,033	2,114,443	70.26	19
Alma 5	471,470,000	3,482,874	2,968,331	65.96	16
Genoa 1	935,200	92,562	37,061	0.0	35
Stoneman 1 and 2	185,079,300	1,961,998	1,229,354	40.83	25,22
Genoa 3	2,075,658,000	13,228,742	10,469,298	68.56	7
LACBWR	332,814,000	1,771,280	931,407	69.08	11
Flambeau (Hydro)	67,504,000	47,094	None	51.37	25
		1975			
Alma 1,2,3	207,681,000	2,802,144	2,473,644	45.81	
Alma 4	367,107,000	3,603,388	3,035,465	77.04	
Alma 5	351,993,000	3,439,490	2,722,670	49.24	
Genoa 1	79,400	39,332	5,201	0.0	
Stoneman 1 and 2	201,051,000	2,413,391	1,694,700	44.35	
Genoa 3	1,743,409,000	17,314,471	13,197,232	57.58	
LACBWR	280,361,000	2,215,550	761,085	58.19	
Flambeau (Hydro)	67,147,000	80,694	22,653**	51.10	
		1976 (Jan.-July)			
Alma 1,2,3	106,117,000	1,681,628	1,371,837	40.11	
Alma 4	48,167,000	736,971	451,757	17.32	
Alma 5	270,697,000	3,242,063	2,777,289	64.89	
Genoa 1	93,000	17,723	4,140	0.0	
Stoneman 1 and 2	90,490,000	1,362,888	954,410	34,21	
Genoa 3	1,106,592,000	11,960,880	10,035,592	62.63	
LACBWR	60,834,000	884,743	257,004	21.64	
Flambeau (Hydro)	44,418,000	48,164	14,163**	57.9	

Year	Adjusted Seasonal Demand (Mw_e)	Adjusted Generating Capacity (Mw_e)	Percent Reserve with LACBWR	
Summer 1976	413	493	19.4	
Winter 1976	542	623	14.9	
Summer 1977	445	550	23.6	
Winter 1977	584	657	12.5	
Summer 1978	480	530	10.4	
Winter 1978	557	610	9.5	
Summer 1979	517	620	19.9	New 350 Mw
Winter 1979	674	876	30.0	Unit Added
Summer 1980	553	772	39.6	
Winter 1980	722	876	21.3	
Summer 1981	593	880	48.4	
Winter 1981	773	876	13.3	
Summer 1982	635	845	33.1	
Winter 1982	829	876	5.7	
Summer 1983	681	880	36.1	
Winter 1983	888	876	0.0	
Summer 1984	728	880	20.9	
Winter 1984	952	876	0.0	
Summer 1985	781	1030	31.9	
Winter 1985	1020	1026	6.0	

* Includes Fuel Costs
** Water Toll

DAIRYLAND POWER COOPERATIVE, STUDY 791Ø, 1978 PRS FORECAST

ESTIMATED LOAD & GENERATING CAPABILITY DATA - AS COMMITTED
MEGAWATTS

REPORTING SYSTEM OR POOL = DAIRYLAND POWER COOPERATIVE

UPDATED TO
DATE 11-21-79 PAGE 1

		SUM 1979	WIN 1979	SUM 198Ø	WIN 198Ø	SUM 1981	WIN 1981	SUM 1982	WIN 1982	SUM 1983	WIN 1983
1	SEASONAL SYSTEM DEMAND	457	64Ø	497	696	538	754	583	793	614	831
2	ANNUAL SYSTEM DEMAND	58Ø	64Ø	64Ø	696	696	754	754	793	793	831
3	FIRM PURCHASES - TOTAL	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
4	FIRM SALES - TOTAL	4	4	4	4	4	4	4	4	4	4
5	SEASONAL ADJUSTED NET DEMAND (1-3+4)	461	644	5Ø1	7ØØ	542	758	587	797	618	835
6	ANNUAL ADJUSTED NET DEMAND (2-3+4)	584	644	644	7ØØ	7ØØ	758	758	797	797	835
7	NET GENERATING CAPABILITY (OWNED)	699	1Ø43	1Ø48	1Ø43	1Ø48	1Ø43	1Ø48	1Ø43	1Ø48	1Ø43
8	PARTICIPATION PURCHASES - TOTAL	56	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	75
9	PARTICIPATION SALES - TOTAL	19Ø	17Ø	342	17Ø	185	17Ø	225	17Ø	255	17Ø
1Ø	ADJUSTED NET CAPABILITY (7+8-9)	565	873	7ØØ	873	863	873	823	873	793	948
11	NET RESERVE CAPACITY OBLIGATION (6 X 15%)	88	97	97	1Ø5	1Ø5	114	114	12Ø	12Ø	125
12	TOTAL FIRM CAPACITY OBLIGATION (5+11)	549	741	598	8Ø5	647	872	7Ø1	917	738	96Ø
13	SURPLUS OR DEFICIT(-) CAPACITY (1Ø-12)	16	132	1Ø8	68	216	1	122	-44	55	-12

SUMMER: MAY 1 - OCT 31; WINTER: NOV 1 - APR 3Ø.

DAIRYLAND POWER COOPERATIVE, STUDY 791Ø, 1978 PRS FORECAST
COMMITTED PURCHASES AND SALES

MEGAWATTS

REPORTING SYSTEM OR POOL - DAIRYLAND POWER COOPERATIVE

UPDATED TO
DATE 11-21-79 PAGE 1

	SUM 1979	WIN 1979	SUM 198Ø	WIN 198Ø	SUM 1981	WIN 1981	SUM 1982	WIN 1982	SUM 1983	WIN 1983
FIRM PURCHASES										
TOTAL FIRM PURCHASES	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
FIRM SALES										
LSDP	4	4	4	4	4	4	4	4	4	4
TOTAL FIRM SALES	4	4	4	4	4	4	4	4	4	4
PARTICIPATION PURCHASES										
MFC	2Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
NPPD NEB CTY	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	75
OTP BIG STN	16	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
OTP	2Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
TOTAL PARTICIPATION PURCHASES	56	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	75
PARTICIPATION SALES										
CPA	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø
MPL	Ø	Ø	64	Ø	Ø	Ø	Ø	Ø	Ø	Ø
LSDP	Ø	Ø	Ø	Ø	15	Ø	Ø	Ø	Ø	Ø
NSP JPM 1	Ø	Ø	1Ø8	Ø	Ø	Ø	2Ø	Ø	1Ø	Ø
NPPD JPM 1	Ø	Ø	Ø	Ø	Ø	Ø	35	Ø	Ø	Ø
ROCH	2Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	75	Ø
TOTAL PARTICIPATION SALES	19Ø	17Ø	342	17Ø	185	17Ø	225	17Ø	255	17Ø

GENERATING UNITS INCLUDING JPM 1-35Ø--W'79
PROJECT 87-52Ø--W'87
GENERATION UNITS RETIRED IN 1987 GENOA 1-12.1
TWIN LAKES-8.7

DAIRYLAND POWER COOPERATIVE, STUDY 791Ø, 1978 PRS FORECAST

ESTIMATED LOAD & GENERATING CAPABILITY DATA - AS COMMITTED
MEGAWATTS

REPORTING SYSTEM OR POOL - DAIRYLAND POWER COOPERATIVE

UPDATED TO
DATE 11-21-79 PAGE 2

		SUM 1984	WIN 1984	SUM 1985	WIN 1985	SUM 1986	WIN 1986	SUM 1987	WIN 1987	SUM 1988	WIN 1988
1	SEASONAL SYSTEM DEMAND	646	872	68Ø	913	716	955	757	1ØØ1	798	1Ø48
2	ANNUAL SYSTEM DEMAND	831	872	872	913	913	955	955	1ØØ1	1ØØ1	1Ø48
3	FIRM PURCHASES - TOTAL	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
4	FIRM SALES - TOTAL	4	4	4	4	4	4	4	4	4	4
5	SEASONAL ADJUSTED NET DEMAND (1-3+4)	65Ø	876	684	917	72Ø	959	761	1ØØ5	8Ø2	1Ø52
6	ANNUAL ADJUSTED NET DEMAND (2-3+4)	835	876	876	917	917	959	959	1ØØ5	1ØØ5	1Ø52
7	NET GENERATING CAPABILITY ([illegible])	1Ø48	1Ø43	1Ø48	1Ø43	1Ø48	1Ø43	1Ø48	1542	1547	1542
8	PARTICIPATION PURCHASES - TOTAL	Ø	75	Ø	75	Ø	75	Ø	Ø	Ø	Ø
9	PARTICIPATION SALES - TOTAL	245	17Ø	245	17Ø	245	17Ø	17Ø	17Ø	17Ø	17Ø
1Ø	ADJUSTED NET CAPABILITY (7+8-9)	8Ø3	948	8Ø3	948	8Ø3	948	878	1372	1377	1372
11	NET RESERVE CAPACITY OBLIGATION (6 X 15%)	125	131	131	138	138	144	144	151	151	158
12	TOTAL FIRM CAPACITY OBLIGATION (5+11)	775	1ØØ7	815	1Ø55	858	11Ø3	9Ø5	1156	953	121Ø
13	SURPLUS OR DEFICIT(-) CAPACITY (1Ø-12)	28	-59	-12	-1Ø7	-55	-155	-27	216	424	162

SUMMER: MAY 1 - OCT 31; WINTER: NOV 1 - APR 3Ø.

DAIRYLAND POWER COOPERATIVE, STUDY 791Ø, 1978 PRS FORECAST
COMMITTED PURCHASES AND SALES

MEGAWATTS

REPORTING SYSTEM OR POOL - DAIRYLAND POWER COOPERATIVE

UPDATED TO
DATE 11-21-79 PAGE :2

	SUM 1984	WIN 1984	SUM 1985	WIN 1985	SUM 1986	WIN 1986	SUM 1987	WIN 1987	SUM 1988	WIN 1988
FIRM PURCHASES										
TOTAL FIRM PURCHASES	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
FIRM SALES										
LSDP	4	4	4	4	4	4	4	4	4	4
TOTAL FIRM SALES	4	4	4	4	4	4	4	4	4	4
PARTICIPATION PURCHASES										
NPPD NEB CTY.............................	Ø	75	Ø	75	Ø	75	Ø	Ø	Ø	Ø
TOTAL PARTICIPATION PURCHASES	Ø	75	Ø	75	Ø	75	Ø	Ø	Ø	Ø
PARTICIPATION SALES										
CPA	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø	17Ø
NPPD JPM 1	75	Ø	75	Ø	75	Ø	Ø	Ø	Ø	Ø
TOTAL PARTICIPATION SALES	245	17Ø	245	17Ø	245	17Ø	17Ø	17Ø	17Ø	17Ø

GENERATING UNITS INCLUDING JPM 1-35Ø--W'79
PROJECT 87-52Ø--W'87
GENERATION UNITS RETIRED IN 1987 GENOA 1-12.4
TWIN LAKES-3.7

DAIRYLAND POWER COOPERATIVE

La Crosse, Wisconsin

54601

August 13, 1976

In reply please
refer to LAC-4130

Docket No. 50-409

Mr. George W. Knighton, Chief
Environmental Projects Branch 1
United States Nuclear Regulatory
Commission
Washington, D. C. 20555

RECEIVED AUG 17 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

SUBJECT: LACBWR - EIS - Comments

Dear Mr. Knighton:

Dairyland Power Cooperative has reviewed the draft Environmental Impact Statement related to our La Crosse Boiling Water Reactor as proposed by your staff. Enclosed are our comments of that document.

Basically, we have found two areas which do not appear to have been properly evaluated in the statement. These areas are the radioactive liquid waste system and the radioactive off-gas waste system. It is our opinion that these systems as presently designed cannot be operated as assumed in the EIS. Therefore, it will be necessary to re-evaluate these portions of the EIS.

Very truly yours,

DAIRYLAND POWER COOPERATIVE

John P. Madgett, General Manager

JPM:cw
Enclosure

83

Dairyland Power Cooperative Comments on
LACBWR EIS

Section 3.6 It is difficult to determine why the EIS source term estimates for liquid and gaseous radioactive releases are based on estimates by a computer code when eight years of actual release data are available for evaluation.

Section 3.6.2.1 and 3.6.2.2 The EIS assumes the radioactive liquid wastes collected by the Containment Building Collection Subsystem and the Turbine Building Collection Subsystem are processed through an evaporator and polishing demineralizer. This does not appear to be a valid assumption when the evaporator design is only 500 lbs/hr (1 gpm) and the polishing demineralizer contains only 9 cu. ft. of resin (6 cation and 3 anion). If the volume of liquid wastes as shown in the effluent reports were used to estimate the amount of liquids that could be passed through the evaporator and polishing demineralizer, one determines that only about 20 percent of the liquid wastes could be treated.

Section 3.6.2.3 The EIS states that the difference between the staff's estimate of radioactive liquid releases of 0.21 Ci/yr and Dairyland's reported radioactive liquid releases of 12.7 Ci/yr for 1974 is due to the under-utilization of installed processing facilities. It is Dairyland's opinion that the majority of this difference has not occurred because of the under-utilization of equipment but because the staff has not properly evaluated the liquid waste system or the manner in which radioactive liquid wastes are produced at LACBWR. First, since the evaporator is only of 1 gpm capacity, only 20 percent of the radioactive liquid wastes could be processed if it were utilized 80 percent of the time. Second, the staff failed to recognize that 52 percent of LACBWR's radioactive liquid release in 1974 was ^{58}Co, which is produced by ^{58}Ni being leached from the feedwater heaters and activated by neutrons to ^{58}Co.

Section 3.6.3.4 The EIS states that the difference between the staff's estimate of radioactive gaseous release of 9500 Ci/yr and Dairyland's reported gaseous release of 53,000 Ci/yr for 1974 is due to bypassing of the recombiner and storage tank portion of the off-gas processing system. It is Dairyland's opinion that this difference results from the improper evaluation of the off-gas system, not from being bypassed. The off-gas system storage tanks are not designed for continuous hold-up of radioactive gases but are designed for a 72-hour storage capability. Thus, the EIS should have evaluated the off-gas released with a 10 minute hold-up not with a 72-hour hold-up.

APPENDIX B

THE STATE HISTORICAL SOCIETY OF WISCONSIN

816 STATE STREET / MADISON, WISCONSIN 53706 / JAMES MORTON SMITH, DIRECTOR

Office of the Director

June 21, 1974

RECEIVED JUL 5 1974

Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

LaCrosse Boiling Water Reactor
Genoa, Vernon County
Docket No. 50-409

Dear Mr. Knighton:

We have checked our records for the Genoa area and have determined that there are no known historic structures in the area other than the church and the markers you have listed in your letter of May 21.

Our records indicate that the following archeological sites are in the general vicinity of the LaCrosse Boiling Water Reactor:

A group of four conical mounds in the NE1/4, SW1/4 of Section 16, T. 13 N., R. 7 W.

A group of two conical mounds in the NW1/4, SW1/4 of Section 28, T. 13 N., R. 7 W.

A mound group of unknown size probably in the SW1/4, NW1/4 of Section 33, T. 13 N., R. 7 W.

Two conical mounds on the river flat on the north branch of the Bad Axe River in the NE1/4 of Section 1, T. 12 N., R. 7 W.

A mound group consisting of one bird effigy and three conicals on the south side of the Bad Axe River in the N1/2, SE1/4 of Section 12, T. 12 N., R. 7 W.

These sites were reported to the Historical Society in 1912. We do not know if the sites still exist or if other sites are located within the project area since a comprehensive survey has never been done. Until an on-site survey by professional archeologists has been provided for, we cannot assess the impact of this project on archeological remains.

Mr. George W. Knighton, Chief - 2 June 21, 1974

Copies of your letter and my reply have been sent to the Vernon County Historical Society. If additional information is received from the local society it will be forwarded to you.

Sincerely,

James Morton Smith

JMS:bwc
cc: Vernon County Historical Society
Mr. Robert Bauer
Mr. Floyd E. Wheeler
Mr. T. A. Steele

APPENDIX C

RADIOLOGICAL MODELS AND ASSUMPTIONS

This Appendix describes the models and assumptions used to obtain estimates of population doses of the potential radiological impact from normal operation of the La Crosse nuclear power station.

Dose Definitions

Individual doses from specific radionuclides were estimated using standard internal dosimetric techniques in accordance with the recommendations of ICRP.[1,2,3] All internal dose conversion calculations have been made using the maximum permissible concentrations listed in ICRP publications II and VI. Data on breathing rates, organ masses, and other physiological parameters are those implied by the standard man of ICRP II.

The isotopic concentration levels in the environment used in the dose calculations were conservatively assumed to be those which would exist during the final year of plant life. A 30-year plant operational lifetime was assumed for calculating buildup of long-lived activity in the environment. Calculated doses represent a 50-year dose commitment which would be received by the population during one year of exposure to radioactive releases from the facility at the levels described; that is, the calculated doses reflect the dose that a person would receive over fifty years from radioactive materials to which that person was exposed for one year. For isotopes with a short effective half-life, the exposure essentially all occurs in the year of the intake. For isotopes with a longer effective half-life, the dose resulting from intake in any one year may be spread over a long period. The 50-year dose commitment method computes the dose associated with any given year's intake, even if that dose is due to a long-lived isotope and is spread out over the lifetime of the person exposed.

Receiving Water

The liquid effluent population doses previously used by the staff were conservative. For example, fish were assumed to have come to equilibrium with the radioactivity content of the water in which they were caught. Thus, the man-rem developed previously has been accepted for this evaluation and incorporated into the sum. In any case, the liquid effluents contribute only small fractions of the total impact of the station.

Atmospheric Effluents

For a uniform population density the population dose may be written as

$$\text{Population dose} = K \bar{\Psi} P$$

where $\bar{\Psi}$ is the spatially averaged concentration time integral appropriate for a population of P individuals.

Atmospheric Effluents Which Deposit (Radioiodine and Particulates)

At any point, the concentration time integral Ψ, will be related to the ground concentration w, and the deposition velocity, V_g, by

$$V_g = w/\Psi$$

Thus, the population dose can be expressed as

$$\text{Population dose} = K \bar{W} P/V_g$$

where $\bar{W}$ is the average ground concentration appropriate for the population P. In the above equation only the average ground concentration, $\bar{W}$, is needed. Noting that whatever is released will eventually settle, we can define the average $\bar{W}$ over a large arbitrary area as

$$\bar{W} = Q/A$$

where Q is the total source releases. This gives

$$\text{Population dose} = K\ Q\ P/A\ V_g$$

where P/A is the average population density (people per square meter), Q is the total source released (curies), V_g is the deposition velocity (meters per second) and K is the dose conversion factor (rem per Ci-sec/m^3).

The doses resulting from ground plane irradiation of the population were primarily based on the Oak Ridge EXREM III Code.[4] Data on certain other isotopes were based on Battelle studies.[5] Basically, the method used consists of determining the gamma energy at 100 cm above an assumed infinite ground plane. Buildup of long-lived activity on the ground from 30 years of continuous deposition includes ingrowth of daughter products. No beta doses from ground plane irradiation were treated, as vegetation on the ground, clothing, and the travel distance in air all combine to make this dose contribution very small. In any case, the contribution to the total U.S. population dose from ground plane radiation is negligible.

Food Uptake

For exposure from airborne radioisotopes resulting from food uptake, the population exposure is determined not by the density of people in the area of the food crop, but by the number of persons that can be fed by the affected crop. We have considered the exposure associated with three principal pathways: direct ingestion of affected vegetation; consumption of meat from animals fed on affected vegetation; consumption of milk from animals fed on affected vegetation.

For our interim estimates, ground deposition was computed as directed above. Vegetation density used was 2,300 grams vegetation per square meter and 440 grams grass per square meter of pasture[6] which is typical of average agricultural and pasture land.

Concentrations of isotopes on the soil assumed buildup of the isotope from continuous deposition over the facility lifetime (30 years). Also included was ingrowth of radioactive daughter products. Isotopes were assumed to be deposited directly on vegetation as well as deposited on soil and taken up by plant roots. No loss of radioisotopes from soil by weathering or other removal mechanisms is included so that the calculated results tend to be conservative.

Concentrations of isotopes directly deposited on vegetation assumed an effective 13-day weathering removal half-life from plant leaves in addition to the radiological half-life. Since both soil deposition and vegetation deposition are treated assuming the full original airborne concentration (i.e., deposition of isotopes on the soil was not depleted to account for the isotopes deposited on vegetation before they reach the soil), material weathered from the plants to the soil has already been accounted for. Thus the doses do not need to be separately treated. Of the amount directly deposited on vegetation, 30 percent was assumed to be absorbed by the plant.

This results in a computed concentration of radioisotopes in agricultural vegetation in the affected area. For the portion of the vegetation which is assumed to go directly to human consumption, a decay time of 7 days was assumed in the transfer of foodstuffs from the field to ultimate consumption.

In addition to the portion going directly to human consumption, vegetation containing radioisotopes as computed above is assumed to be fed to meat and milk animals. Cattle were assumed to have ingested at a rate equivalent to 50 kg/day.[7] To maintain a high productivity, animals are generally offered feeds, such as harvested forages and grains to supplement or to totally replace the pasture intake.[7,8,9] Milk animals were assumed to obtain 80% of the daily intake from pasture, with the remaining fraction desired from harvested forages and grains. Beef animals were assumed to obtain 50% of their daily intake from pasture and the remaining fraction from harvested forages and grains.

For the animal feed coming from stored feeds a two-month delay was assumed, which results in decay of short-lived isotopes. For the portion coming directly from pastureland uptake, no decay was assumed between deposition and animal uptake.

Transfer factors from animal uptake to milk were taken from UCRL-50163, C. Ng et al.[10] For population dose estimates, a one-day milk supply delay factor was used, and a seven-day meat supply delay factor was used between consumption of vegetation by the animal and ultimate consumption of meat or milk from that animal by persons in the population. This gives a concentration of radioisotopes in meat and milk from agricultural lands in the affected area.

To convert from concentration of activity in foodstuffs to population dose, we have assumed that the affected land has an average agricultural productivity equivalent to the average Wisconsin state productivity.

This results in an average land productivity of:

Vegetation	- 25 kg/day-mile^2
Meat	- 36 kg/day-mile^2
Milk	- 408 kg/day-mile^2

Atmospheric Releases Which Do Not Deposit (Noble Gases, Carbon-14 and Tritium)

Noble gases, C-14 and tritium were assumed to disperse to the atmosphere without deposition, but radioactive decay which limits spread of the effluents was explicity treated. The population dose after integrating along the plume pathlength r is given by

$$\text{Population dose} = K\ Q\ P(1-\exp(-\ \lambda\ r/v))/\lambda LA$$

where λ is the radioactive decay constant (sec^{-1}), v is the resultant wind speed and L is the height of the assumed vertical air mixing. Values for L, v, and r of 1000 meters, 2 m/sec, and 1.6×10^6 meters, respectively, were used in the calculations. In addition, long-lived radioisotopes i.e., Krypton-85, tritium and carbon-14, were assumed to be distributed by dilution in the earth's atmosphere. These were considered to build up over 30 years of plant life. Unlike radioactivity ejected into the stratosphere and then appearing in the high latitude troposphere as in weapon testing, the emission of concern here is directly introduced into the mid-latitudes of the troposphere. Transfer of tropospheric air between the two hemispheres, although inhibited by wind patterns in the equatorial region, is considered to yield a hemisphere average tropospheric residence time of about two years with respect to hemispheric mixing.[11] This time constant is quite short with respect to the expected plant lifetime and mixing in both hemispheres can be assumed for end of plant life evaluations. Carbon-14 was assumed to be released in oxide form which maximizes its availability to the population via food chains. Other chemical forms such as methane would not be as readily available. Atmospheric tritium was considered to enter the hydrosphere as noted below. The carbon-14 was considered to enter the carbon cycle.[12,13] which results in an atmospheric residence time of about 4-6 years. Doses were calculated assuming all carbon in the body reaches the same equilibrium ratio of carbon-14 to natural carbon, as exists in air.

Tritium

Tritium was assumed to mix uniformly in the world's hydrosphere. The hydrosphere was assumed to include all the atmospheric water and the upper 70 meters of the oceans. Having determined this equilibrium concentration of tritium in the world, doses to man were calculated by assuming all the hydrogen in the body reaches the same equilibrium ratio of tritium to hydrogen as exists in the air and water of the environment.

Population Density and Changes - Local Impact

The doses for shine dose from radioactive materials deposited on the ground and for short-lived noble gases were based on a population density of 79 persons/sq mile characteristic of the Wisconsin state population. These components of dose would be increased if the close in populations, the populations principally exposed, exceeded this value substantially. However, as noted, these components do not significantly affect the total and would be reviewed on an individual case basis for the Appendix I cost-benefit analysis.

Local food uptake exposures are not based on population density, but, rather, on agricultural productivity, and, consequently, are not directly affected by population growth but more by changes in land use. Similarly, the principal future impact on estimates from liquid effluents would result if water use patterns in the nearby areas are changed, e.g., if a drinking water intake for a large city is constructed near the plant discharge. Such future changes are difficult to predict.

To assure adequate control of releases, allowing for future changes in water or land use, the operating license technical specifications will provide for periodic reassessment of changes in land and water use patterns. This will provide a periodic reassessment of the adequacy of facility performance in order to maintain exposures of the public health within the Appendix I guides.

References

1. Recommendations of the International Commission on Radiological Protection, ICRP, Publication 2, Pergamon Press, Oxford, 1959.

2. Recommendations of the International Commission on Radiological Protection, ICRP, Publication 6, Pergamon Press, Oxford, 1962.

3. Recommendations of the International Commission on Radiological Protection, ICRP, Publication 10, Report of Committee IV, Pergamon Press, Oxford, 1968.

4. D.K. Trubey and S.U. Kaye, "The EXREM III Computer Code for Estimating External Radiation Doses to Populations from Environmental Releases," ORNL-TM-4322, 1973.

5. "Final Environmental Statement Concerning Proposed Rule Making Action: Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as Practicable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," U.S. Atomic Energy Commission, WASH-1258, July 1973.

6. "Statistical Abstract of the United States," 93rd Edition, U.S. Department of Commerce, Bureau of Census, 1972.

7. J.T. Reid, "Forages for Dairy Cattle," in "Forages," M.F. Heath, D.S. Metcalfe, and R.F. Barnes, Eds., 3rd Edition, 1973.

8. W.K. Kennedy, J.T. Reid, and M.J. Anderson, "Evaluation of Animal Production Under Different Systems of Grazing," J. Dairy Sci. 42:679, 1959.

9. G.C. Allen, E.F. Hodges, and M. Devers, "National and State Livestock-Feed Relationships," Economic Research Service, U.S. Department of Agriculture, Stat. Bull. 446, Suppl., 1972.

10. C. Ng et al., "Prediction of the Maximum Dosage to Man from the Fallout of Nuclear Devices," in "Handbook for Estimating the Maximum Internal Dose from Radionuclides Released to the Biosphere," UCRL-50163, Part IV, 1968.

11. C.E. Junge, "Studies of Global Exchange Processes in the Atmosphere by Natural and Artificial Tracers," J. Geophys. Res. 68:3849, 1963.

12. L. Machta, "Carbon in the Biosphere," G.W. Woodwell and G.V. Pecan, Eds., U.S. Atomic Energy Commission, Technical Information Center, 1973.

13. J.C. Houtermans, H.E. Suess, and H. Oeschger, "Reservoir Models and Production Rate Variations of Natural Radiocarbon," J. Geophys. Res. 78:1897, 1973.

APPENDIX D

SPENT FUEL STORAGE CAPACITY ADDITIONS

1976 Addition

In 1976, the capacity of the spent fuel storage pool at LACBWR was increased from 84 to 134 spent fuel assemblies. The expansion was carried out by installing four new racks within the existing spent fuel storage well. No new construction external to the well or new pool water cleaning and cooling facilities were required.

The expansion provided for two more years of fuel storage (24 assemblies per year) in addition to the three-year storage capability already present and, in the absence of away-from-reactor storage, was necessary for continued plant operation.

The incremental fuel to be stored was old fuel that had already been stored at least three years. The radioactivity and heat generation of the older fuel is very roughly a fifth that of freshly discharged fuel and, consequently, the increased radioactivity and heat output is relatively small compared to that of freshly discharged fuel.

In an environmental impact appraisal[1] prepared for the fuel pool expansion, the staff found that only very slight or no increase in external radiation or radioactivity releases would occur. No nonradiological impacts would occur. The staff made a negative declaration as to the need for an environmental impact statement. Permission for construction was granted by the ASLB.

1978 Proposed Addition

In 1978, Dairyland Power Cooperative proposed an increase in capacity of the spent fuel storage pool from 134 assemblies to 440 assemblies. The capacity increase is necessary for continued plant operation. The expansion will be carried out by replacing the present storage racks with new racks of a two-tier design. No new construction external to the fuel pool will be required and no new water cleanup or cooling capacity will be needed.

The incremental fuel will have been stored at least five years and the contributions to the heat load and radioactivity will be below those of the three-year-old fuel previously mentioned.

The staff has prepared a safety evaluation[2] and environmental impact appraisal[3] of the proposed action. Based on past experience,[4] calculations, and evaluations,[2,3] the staff found that all established safety criteria, codes, and standards would be met by the installation. Negligible increases in radiation exposure and released radioactivity would be caused by the remodeled facility. No detectable nonradiological effects will occur.

Alternatives to the action were considered;[3] however, they were found to be less satisfactory than the proposed action. The staff found significant economic advantages in the proposed action,[3] and it was the most cost effective of the alternatives considered. A negative declaration on the need for an environmental impact statement was made.

Hearings were held in October 1979, and the amendment to modify the spent fuel pool was approved by the Atomic Safety and Licensing Board in an initial decision on January 10, 1980. Cost-benefit analysis and the need for power were considered by the ASLB in its decision.

References

1. "Environmental Impact Appraisal by the Division of Reactor Licensing Supporting Facility Modification to Increase the Capacity of the Spent Fuel Storage Pool," U.S. Nuclear Regulatory Commission, Docket No. 50-409, November 1975.

2. "Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Facility Modifications to Increase the Capacity of the Spent Fuel Storage Pool," U.S. Nuclear Regulatory Commission, Docket No. 50-409, July 1979.

3. "Environmental Impact Appraisal by the Office of Nuclear Reactor Regulation Supporting Amendment to DPR-45," U.S. Nuclear Regulatory Commission, Docket No. 50-409, July 1979.

4. A.B. Johnson, Jr., "Spent Fuel Storage Experience," Nuclear Technology 43:165, 1979.

NEPA POPULATION DOSE ASSESSMENT

Population dose commitments are calculated for all individuals living within 80 km (50 miles) of the facility employing the same models used for individual doses (see Regulatory Guide 1.109, Rev. 1). In addition, population doses associated with the export of food crops produced with the 80-km region and the atmospheric and hydrospheric transport of the more mobile effluent species such as noble gases, tritium, and carbon-14 have been considered.

E.1 Noble Gas Effluents

For locations within 80 km of the reactor facility, exposures to these effluents are calculated using the atmosphere dispersion models in Regulatory Guide 1.111, Rev., 1, and the dose models described in Section 5.4 and Regulatory Guide 1.109, Rev. 1. Beyond 80 km, and until the effluent reaches the northeastern corner of the United States, it is assumed that all the noble gases are dispersed uniformly in the lowest 1,000 meters of the atmosphere. Decay in transit was also considered. Beyond this point, noble gases having a half-life greater than one year (e.g., Kr-85) were assumed to completely mix in the troposphere of the world with no removal mechanisms operating.

Transfer of tropospheric air between the northern and southern hemispheres, although inhibited by wind patterns in the equatorial region, is considered to yield a hemisphere average tropospheric residence time of about two years with respect to hemispheric mixing. Since this time constant is quite short with respect to the expected midpoint of plant life (15 yrs), mixing in both hemispheres can be assumed for evaluations over the life of the nuclear facility. This additional population dose commitment to the U.S. population was also evaluated.

E.2 Iodines and Particulates Released to the Atmosphere

Effluent nuclides in this category deposit onto the ground as the effluent moves downwind, which continuously reduces the concentration remaining in the plume. Within 80 km of the facility, the deposition model in Regulatory Guide 1.111, Rev. 1, was used in conjunction with the dose models in Regulatory Guide 1.109, Rev. 1. Site specific data concerning production, transport and consumption of foods within 80 km of the reactor were used. Beyond 80 km, the deposition model was extended until no effluent remained in the plume. Excess food not consumed within the 80-km distance was accounted for, and additional food production and consumption representative of the eastern half of the country was assumed. Doses obtained in this manner were then assumed to be received by the number of individuals living within the direction sector and distance described above. The population density in this sector is taken to be representative of the Eastern United States, which is about 62 people per square km.

E.3 Carbon-14 and Tritium Released to the Atmosphere

Carbon-14 and tritium were assumed to disperse without deposition in the same manner as krypton-85 over land. However, they do interact with the oceans. This causes the carbon-14 to be removed with an atmospheric residence time of 4 to 6 years with the oceans being the major sink. From this, the equilibrium ratio of the carbon-14 to natural carbon in the atmosphere was determined. The same ratio was then assumed to exist in man so that the dose received by the entire population of the U.S. could be estimated. Tritium was assumed to mix uniformly in the world's hydrosphere, which was assumed to include all the water in the atmosphere and in the upper 70 meters of the oceans. With this model, the equilibrium ratio of tritium to hydrogen in the environment can be calculated. The same ratio was assumed to exist in man, and was used to calculate the population dose, in the same manner as with carbon-14.

E.4 Liquid Effluents

Concentrations of effluents in the receiving water within 80 km of the facility were calculated in the same manner as described above for the Appendix I calculations. No depletion of the nuclides present in the receiving water by deposition on the bottom of the Mississippi River was assumed. It was also assumed that aquatic biota concentrate radioactivity in the same manner as was assumed for the Appendix I evaluation. However, food consumption values appropriate for the average individual, rather than the maximum, were used. It was assumed that all the sport and commercial fish and shellfish caught within the 80-km area were eaten by the U.S. population.

Beyond 80 km, it was assumed that all the liquid effluent nuclides except tritium have deposited on the sediments so they make no further contribution to population exposures. The tritium was assumed to mix uniformly in the world's hydrosphere and to result in an exposure to the U.S. population in the same manner as discussed for tritium in gaseous effluents.

E.5 Radiological

The operational offsite radiological monitoring program is conducted to measure radiation levels and radioactivity in plant environs. The program assists and provides backup support to the detailed effluent monitoring (as required by Regulatory Guide 1.21) which is needed to evaluate individual and population exposure and verify projected or anticipated radioactivity concentrations.

The operational monitoring program is under continuous staff review and any required changes in the program will be incorporated into the Environmental Technical Specifications. Radiological Assessment Branch's Branch Technical Position of November 1979, "An Acceptable Radiological Environmental Monitoring Program," replaces the radiological monitoring portion of NRC Regulatory Guide 4.8 and will be used as the basis for making any required changes in the existing program.

NRC FORM 335 (7-77)

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

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3. RECIPIENT'S ACCESSION NO.

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Final Environmental Statement related to the conversion from a provisional to a full-term operating license
La Crosse Boiling Water Reactor

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13. TYPE OF REPORT
Final Environmental Statement

PERIOD COVERED (Inclusive dates)

14. (Leave blank)

15. SUPPLEMENTARY NOTES
This report pertains to Docket No. 50-409

16. ABSTRACT (200 words or less) A Final Environmental Statement for the Dairyland Power Cooperative for the conversion from a provisional to a full-term operating license for the La Crosse Boiling Water Reactor, Docket No. 50-409, located in Vernon County, Wisconsin, has been prepared by the Office of Nuclear Reactor Regulation. This statement provides (1) a summary of environmental impacts and adverse effects of operation of the facility, and (2) a consideration of principal alternatives (including removal of LACBWR from service, alternative cooling methodology, and alternative waste treatment systems). Also included are the comments of Federal, State, and local governmental agencies and certain non-governmental organizations on the La Crosse Draft Environmental Statement and staff responses to these comments. After weighing environmental, economic, and tehcnical benefits and liabilities, the staff recommends conversion from a provisional operating license to a full-term operating license, subject to specific environmental protection limitations. An operational monitoring program shall be established as part of the Environmental Technical Specifications.

17. KEY WORDS AND DOCUMENT ANALYSIS

17a. DESCRIPTORS

17b. IDENTIFIERS/OPEN-ENDED TERMS

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