Docket file

Docket No. 50-255

AUG 30 1974

Consumers Power Company
ATTN: R. C. Youngdahl
Senior Vice President
212 West Michigan Avenue
Jackson, Michigan 49201

Gentlemen:

The Commission has issued the enclosed Amendment No. 6 to Facility Operating License No. DPR-20 for the Palisades Nuclear Generating Plant. This amendment includes Change No. 10 to the Technical Specifications, Appendix A, and is in response to your requests dated September 28, 1973 and October 30, 1973.

This amendment pertains to Section 3.9 Effluent Release and Section 4.11 Environmental Monitoring Program, which take into account the conversion from once-through cooling to the closed-cycle cooling system utilizing two mechanical draft cooling towers and also modifications to the radioactive waste treatment system to assure the releases of radioactive effluents will essentially approach zero. The information supporting these changes relate to environmental aspects that the staff previously reviewed and described in the Final Environmental Statement for the Palisades Plant issued in June 1972.

Copies of the related Safety Evaluation, Environmental Evaluation and the Federal Register Notice are also enclosed with Amendment No. 6.

Sincerely,

Original signed by

Karl R. Goller, Assistant Director
for Operating Reactors
Directorate of Licensing

See previous yellow for concurrences

Enclosures:
1. Amendment No. 6 to Facility Operating License No. DPR-20 and Change No. 10 to Appendix A, Tech Specs
2. Environmental Evaluation
3. Safety Evaluation
4. Federal Register Notice

cc w/enclosures: See next page

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	TWamback	RAPurple		LHiggenbotham
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OFFICE➤			L:EP-1	L:EP-1	L:AD/EP	L:OR
SURNAME➤			MJOestmann:sh	GWKnighton	DRMuller	KRGoller
DATE➤			8/27/74	8/28/74	8/28/74	8/30/74

Form AEC-318 (Rev. 9-53) AECM 0240 ☆ U. S. GOVERNMENT PRINTING OFFICE: 1974-526-166

Docket No. 50-255

Consumers Power Company
ATTN: R. C. Youngdahl
Senior Vice President
212 West Michigan Avenue
Jackson, Michigan 49201

Gentlemen:

By letters dated September 28, 1973, and October 30, 1973, you proposed changes regarding environmental considerations presented in the Technical Specifications (Appendix A) of Provisional Operating License No. DPR-20, issued to Consumers Power Company for the Palisades Plant. The proposed changes pertain to Section 3.9 Effluent Release and Section 4.11 Environmental Monitoring Program, which take into account the conversion from once-through cooling to the closed-cycle cooling system utilizing two mechanical - draft cooling towers. The information supporting the changes relate to environmental aspects that the staff previously reviewed and described in the Final Environmental Statement for the Palisades Plant issued in June 1972.

During the present plant outage, the staff understands that you are carrying out the changeover to the closed-cycle cooling system. This changeover has required removal of the two circulating water pumps. During any present and future discharges of liquid radioactive wastes, primarily laundry waste, you propose that a minimum flow of 8,000 gpm should exist in the discharge canal when radioactive liquid effluents are discharged from the plant. This minimum flow can be achieved by use of either the service water pumps, or cooling tower blowdown dilution pumps or a combination thereof. The concentration of radioactive wastes in the discharge structure will be governed by the limits presently included in the Technical Specifications. The staff has reviewed the procedures carried out during the changeover and approves them as discussed in the enclosed Environmental Evaluation.

In reference to the proposed change in effluent limits, the staff reviewed your request and Section 3.9 of Appendix A, and approves the change with some modifications as described in the enclosed Environmental Evaluation. This change has taken into account modifications in the radioactive waste treatment system, the amount of water withdrawn from the lake for makeup for the closed-cycle cooling system, the use of sodium hypochlorite and sulfuric acid in the circulating cooling water system, and the dilution flow of the discharges from the plant.

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In reference to the proposed change in the nonradiological environmental monitoring program in Section 4.11 of the Technical Specifications, the staff reviewed your request and Section 4.11 of Appendix A, and approves the request with some modification as discussed in the enclosed Environmental Evaluation. Two reports on the preliminary meteorological and terrestrial monitoring program were provided in your letter of September 28, 1973, which provided details as to the specifics of the sampling and measurement program to be carried out in Specification 4.11.6. Details as to the objectives of the measurement to be made and the specifications of the sampling type, location, frequency, and duration of measurement with supporting basis for such a program have been presented in Specification 4.11.6. The staff evaluation of the operation of Palisades with cooling towers as presented in the Final Environmental Statement indicates that impacts on the environment should be comparable to those from once-through cooling and are considered to be minimal.

The staff has also prepared the enclosed Safety Evaluation of the plant modifications and has concluded that the changes in Sections 3.9 and 4.11 do not involve a significant hazards consideration and there is reasonable assurance that the health and safety of the public will not be endangered. Accordingly, the Commission has issued the enclosed Amendment No. 6 and Change No. 10 to Appendix A, Technical Specification, to the Facility Operating License No. DPR-20.

Sincerely,

Karl R. Goller, Assistant Director
for Operating Reactors
Directorate of Licensing

Enclosures:
1. Amendment No. 6 to Facility Operating License No. DPR-20 and Change No. 10 to Appendix A, Tech Specs
2. Environmental Evaluation
3. Safety Evaluation

cc w/enclosures - See next page

ETSB	OGC	RO
VBenaroya		LHigginbotham
7/ /74	7/30/74	8/ /74

OFFICE	L:EP-1	L:EP-1	L:AD/EP	L:OR	L:OR	L:AD/OR
SURNAME	MJOestmann	GWKnighton	DRMuller	ABurger	RAPurple	KRGoller
DATE	7/10/74	7/19/74	7/ /74	8/26/74	7/ /74	7/ /74

Consumers Power Company

cc w/enclosures:

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CONSUMERS POWER COMPANY

DOCKET NO. 50-255

PALISADES NUCLEAR GENERATING PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 6
License No. DPR-20

1. The Atomic Energy Commission (the Commission) having found that:

   A. The application for amendment by Consumers Power Company for the Palisades Nuclear Generating Plant dated September 28, 1973 and October 30, 1973, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended, and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is a reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. Prior public notice of this amendment is not required since the amendment does not involve a significant hazards consideration.

2. Accordingly, the license is amended by a change to the Technical Specifications as indicated in the attachment to this license amendment and Paragraph 3.B. of Facility License No. DPR-20 is hereby amended to read as follows:

   "(2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised, are hereby

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incorporated in the license. The licensee shall operate the facility in accordance with issued changes thereto through Change No. 10."

3. This license amendment is effective as of the date of its issuance.

FOR THE ATOMIC ENERGY COMMISSION

Karl R. Goller, Assistant Director
for Operating Reactors
Directorate of Licensing

Attachment:
Change No. 10 to
Technical Specifications

Date of Issuance:

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SAFETY EVALUATION BY THE DIRECTORATE OF LICENSING

SUPPORTING AMENDMENT NO. 6 TO FACILITY OPERATING LICENSE NO. DPR-20

CHANGE NO. 10 TO APPENDIX A OF THE TECHNICAL SPECIFICATIONS

CONSUMERS POWER COMPANY

PALISADES NUCLEAR GENERATING PLANT

DOCKET NO. 50-255

MODIFICATION TO THE LIQUID RADWASTE SYSTEM

AND CONDENSER COOLING SYSTEM

Modifications to the Radwaste System

Consumers Power Company (CPC) has provided the capability for reducing the radioactivity in the liquid effluent discharges from the Palisades Plant, except for laundry wastes, to essentially background levels during normal operation and to a small fraction of the limits in 10 CFR Part 20 under abnormal conditions. This capability was achieved by modifications to the original Palisades Radwaste System that are described in Special Report No. 5 which was submitted by CPC by letter dated December 1, 1972, for our review. The staff's preliminary evaluation of the modifications to the Radwaste System is included in Supplement No. 3 to its Safety Evaluation of the Palisades Plant dated June 11, 1971, concluding that the proposed modifications will even further reduce the previously small release of radioactive effluents.

The modifications to the Radwaste System involve the addition of new components to the original system to facilitate additional processing, including evaporation of radioactive liquid wastes. The added components are listed in Table 1-2 in Special Report No. 5 and include new radwaste evaporators, additional storage tanks, and associated pumps, piping, valves, and fittings. Except for the new Primary System Makeup Storage Tank and the Utility Water Storage Tank which will not contain radioactive liquid wastes, all other new tanks and components are housed inside an addition to the Auxiliary Building. The new equipment meets Seismic Class 2 criteria. The Auxiliary Building addition meets Seismic Class 1 criteria, and is designed for loadings and for sustaining the impact of tornado generated missiles, previously accepted by the staff for the original Auxiliary Building.

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CPC has also installed inside the Auxiliary Building addition three additional gas decay tanks to increase the capability for holdup of radioactive waste gases. The new tanks each have a capacity of 225 ft^3 and meet Seismic Class I criteria as do the three original gas decay tanks each with a 100 ft^3 capacity.

The capabilities of the modified Radwaste System for holdup and processing radioactive liquid effluents and for discharging liquid wastes as low as practicable are described in the Environmental Evaluation attached to Change No. 10.

All added components in the modified Radwaste System are housed within the Auxiliary Building addition. The arrangement of the equipment provides that any leakage or spillage of liquid waste would be collected by floor drains and sumps and would either flow to the waste receiver tank or be contained within the building.

The normal sources of radioactivity in liquid wastes are from corrosion and fission products in the primary coolant. The calculated primary coolant activity by isotopes for conditions after 40 years of operation with the originally assumed 1% defective fuel remains unchanged with the modified Radwaste System except for tritium. Because substantially all liquid wastes will be recycled, the tritium in the primary coolant will gradually build up during normal operation and would reach a concentration of 2.8 uCi/cc calculated by CPC, assuming a plant life of 40 years and zero primary coolant leakage. We find that this is an acceptable and conservative estimate for the assumed conditions.

CPC has evaluated the consequences of accidental releases of tritiated water. The maximum dose to the public would result if a rupture of the Safety Injection and Refueling Water Tank is assumed at the time it contains primary coolant with a maximum concentration of 2.8 uCi/cc for the postulated conditions described previously in this Safety Evaluation. It is further assumed that the entire coolant inventory from the ruptured tank is released to Lake Michigan. Our own calculations, using conservative assumptions, indicate a dose of 12 mrem to an individual consuming water from the nearest drinking water supply at South Haven. This is significantly below the allowable yearly dose of 500 mrem in 10 CFR Part 20.

We have also evaluated the potential consequences of a rupture of a new gas decay tank because of its larger capacity of 225 ft^3. The same conservative assumptions that we have previously used in the analysis of this accident involving the assumed rupture of an original tank with 100 ft^3 capacity have been applied to this evaluation. We find that the maximum doses of 2.4 rad at the exclusion boundary and 0.3 rad at the

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LPZ distance that we have previously calculated remains unchanged. This conclusion is valid because the original specific assumption that all of the noble gases that would be contained in the entire volume of the primary coolant system after one day of decay are stored in the tank at the time of the accident is independent of the capacity of the tank that is postulated to fail.

Modifications to the Condenser Cooling System

The Palisades Plant condenser cooling water system has been modified from the once-through condenser cooling system to a closed system that will recycle heated main condenser cooling water through two mechanical draft cooling towers. The modifications have been completed during the maintenance outage that commenced August 11, 1973. The cooling towers will be placed into operation upon return of the plant to service.

The final design of the modifications to the condenser cooling system and minor changes to the service water system have been described in Consumers' Special Report No. 5 submitted by letter dated December 1, 1972, for our review. The submittal was supplemented by letter dated April 23, 1974. The staff's preliminary evaluation of the modifications to the condenser cooling system is included in Supplement No. 3 to its Safety Evaluation of the Palisades Plant dated June 11, 1971.

The modified closed cycle condenser cooling water system includes two mechanical draft cooling towers, two cooling tower pumps, two dilution pumps that will add lake water to the cooling tower blowdown before it is discharged to Lake Michigan, fire equipment and chemical treatment equipment.

Cooling water is recycled to the existing condensers by two new half-capacity wet pit cooling tower pumps which are installed in the cooling tower pump basins located inshore of the original discharge structure. After picking up heat in the condenser, the coolant flows through the original 96-inch discharge lines into the cooling tower pump basins. The circulating water from the pump basins is pumped back to the cooling water distribution header through two newly installed 96-inch pipes.

Cooling tower blowdown is extracted from the circulating water piping near the two condenser inlets to minimize discharge temperatures. The blowdown is discharged to the discharge mixing basin where it mixes with the water supplied by the two new dilution pumps that are installed in the original intake structure. Ample dilution water can be handled by the pumps for limiting the temperature rise in the receiving Lake Michigan water to 5°F.

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The plant service water system discharge piping has been rerouted to the cooling tower makeup basin in the original discharge structure. Service water discharge is used for makeup of cooling tower circulating water that is lost during normal operation by drift, evaporation, and blowdown. The excess service water discharge passes over the overflow weirs into the discharge mixing basin, thence to Lake Michigan.

The modified condenser cooling system meets Seismic Class 3 requirements as did the original once-through condenser cooling system. The cooling towers conform to the latest Cooling Tower Institute (CTI) codes applicable at the time of detailed design, thus meeting the requirements of the Special Technical Specifications included in Appendix A to License No. DPR-20.

The closed cycle condenser cooling system, as was the original once-through system, is only required for heat removal in the plant turbine cycle and does not perform any essential safety related functions. Assuming a total loss of function of the condenser cooling system with consequent loss of condenser vacuum, a turbine trip would be initiated which in turn would result in a reactor scram from the reactor protection system. This occurrence does not involve an unreviewed safety question since it involves the same chain of events as previously evaluated.

The plant service water system does perform essential safety functions. However, only its discharge piping was modified for routing the service water discharge to the discharge makeup basin. The modified "critical portion" of the service water system meets Seismic Class 1 criteria. Cooling water for the cooling tower pump seals is supplied by the service water booster pump from the "non-critical" service water header. We have determined that any failure in this portion of the "non-critical" service water system would be isolated automatically and would not impair the essential safety related functions performed with the "critical" headers in the service water system.

The two mechanical draft cooling towers are located in the sand dunes due south and at distances of 500 feet and 1000 feet respectively from the plant. Because of location and distance, the integrity of safety related plant features would not be impaired assuming damage would occur to the cooling towers from any natural phenomenon.

The modified condenser cooling system is controlled from a separate panel in the control room. Electric power for controls and for powering the new pumps is furnished from busses that are not connected to essential safety related plant features. We have concluded that this separation in the controls and power supply is acceptable.

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Conclusion

We have concluded, based on the reasons discussed above, that the authorization of this change does not involve a significant hazards consideration. We also conclude that there is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Alfred Burger
Operating Reactors Branch #1
Directorate of Licensing

Robert A. Purple, Chief
Operating Reactors Branch #1
Directorate of Licensing

Date:

3.9 EFFLUENT RELEASE

Applicability

Applied to the controlled release of radioactive liquids and gases, residual chlorine, and other chemicals from the plant.

Objectives

To define the conditions for release of radioactive wastes to the closed-cycle cooling blowdown discharge mixing basin and to the plant vent to assure that any radioactive material released is kept as low as practicable and, in any event, is within the limits of 10 CFR 20.

To define the conditions for the release of: (1) chlorine residuals in the blowdown to assure that any residual chlorine released does not exceed 0.02 ppm at the point at which such blowdown water discharge enters Lake Michigan; and (2) spent sulfuric acid in the blowdown to assure that the pH of the discharge does not exceed the range of 6.5 to 8.8 with a maximum artificially-induced variation of 0.5 pH units at which the blowdown discharges into Lake Michigan.

Specifications

Liquid Wastes

3.9.1 The release rate of radioactive liquid effluents shall be such that at all times under normal operating conditions, radioactive materials in liquid discharges released from the plant to Lake Michigan shall be reduced to essentially zero (i.e., lake water background); provided that radioactive materials in the laundry waste system discharges, which cannot be treated in the dirty waste system of the modified liquid radwaste system without the possibility of impairing the function of dirty waste system equipment, maybe released to Lake Michigan at levels not exceeding 2.5×10^{-8} µCi/cc on an annual average basis, as specified in the Special Technical Specifications, Section S-2. This concentration is 25% of the 1×10^{-7} µCi/cc limit for unidentified mixtures in 10 CFR 20, Appendix B, Table II for unrestricted areas. Under abnormal operating conditions, releases shall not exceed, on a quarterly average basis and on an individual isotopic analysis basis, 10% of applicable 10 CFR Part 20 limits, and shall be reduced to essentially zero no later than 60 consecutive days after the commencement of such releases resulting from abnormal operating conditions. See Special Technical Specifications, Section S-2, for further details.

3.9.2 During release of radioactive liquids, the MPC, as defined in 10 CFR 20, Appendix B, Table II, Column 2 and notes thereto, shall not be exceeded at the point of discharge to the lake.

3.9.3 Prior to release of liquid wastes, a sample shall be taken from the tank to be discharged and analyzed. The flow rate from the tank and the discharge rate from the mixing basin shall be determined in order to calculate the concentration of radioactive materials in the mixing basin to demonstrate compliance with 3.9.1 and 3.9.2 above.

3.9.4 During the release of liquid radioactive wastes, the following conditions shall be met.

a. Flow through the mixing basin shall be at least 8,000 gpm.

b. During any release, the discharge monitor shall be in operation with the exception that if it (RIA-1049) is down for maintenance, sampling of the discharge water shall be taken every four hours and each sample analyzed.

3.9.5 Under normal operating conditions, the expected release to the environment from the modified liquid waste system shall be zero after integration of the modified and existing liquid radioactive waste system is completed. All radioactive liquids not meeting Specification 3.9.1 will be recycled or prepared for shipment in accordance with applicable rules, regulations and orders of governmental authorities having jurisdiction and turned over to a carrier or carriers licensed by governmental authorities having jurisdiction for shipment to an authorized disposal area or areas.

Under abnormal operating conditions, such as (but not limited to) steam generator tube leakages, fire, or pipe breakage, liquid radioactive wastes may be discharged to the environment. These discharges shall be performed in accordance with the requirements of the Technical Specifications, Section S-2.2.

3.9.6 The concentration of residual chlorine in water discharged from the plant as a result of cleaning of the closed cycle condenser cooling system shall not exceed 0.02 ppm at the point at which such water enters Lake Michigan.

3.9.7 Simultaneous blowdown and chlorination treatment of the closed-cycle condenser cooling system shall be limited to a total time of not more than sixty minutes in a period of one day.

3.9.8 The total time of each chlorination treatment of the closed cycle condenser cooling system and the service water system, the total quantity of chlorine compound used, the cooling tower blowdown rate, the dilution flow rate and the time of the holdup of the blowdown to allow chemical decomposition of residual chlorine shall be recorded for each chlorination treatment.

3.9.9 During chlorination treatment of the condenser, samples shall be taken of the blowdown water prior to dilution and analyzed with an analytical accuracy capable of detecting ± 0.1 ppm to verify compliance with concentration limits using appropriate dilution factors. In order to assure releases will be no greater than 0.02 ppm of residual chlorine, the blowdown may be secured during and after chlorination to allow the chlorine to decompose to chloride ion due to exposure to light and air.

Because of the use of sulfuric acid to neutralize the makeup water and to control scaling of the closed-cycle cooling system, any blowdown discharge shall be limited to a range of 6.5-8.8 pH with a maximum artificially-induced variation of 0.5 pH unit within this range prior to release to Lake Michigan. No bulk amounts of acids or bases shall be discharged into the lake without prior neutralization.

Thermal discharges of the blowdown from the closed-cycle cooling system mixed with the dilution water shall be limited to an increase of no more than 5F° to assure compliance with the Special Technical Specifications. The heat rejection to the lake from the diluted blowdown shall not exceed 0.5 billion British Thermal Units per hour. The lake shall not receive a heat load which would warm the receiving water at the edge of the mixing zone (as defined by the appropriate authority) more than 3F° above the existing natural water temperature. The lake shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures in °F higher than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	55	60	70	80	80	80	65	60	50

3.9.10 During simultaneous chlorination treatment of the condenser and cooling tower blowdown, any evidence of detrimental effects of chlorine on aquatic life, such as dead fish or fish in distress shall be noted and a record of such evidence shall be maintained with records of the chlorination treatment and reported in the Semi-Annual Operating Reports.

Gaseous Wastes

3.9.11 The average annual release rates of gaseous and airborne particulate wastes shall be limited in accordance with the following equation:

$$\sum \frac{Q_i}{(MPC)_i} \leq 5 \times 10^{11} \text{ (cc/sec)}$$

where Q_i is the annual release rate (μCi/sec) of any radioisotope, i, and $(MPC)_i$ in the units of μCi/cc is defined in Column 1, Table II, of Appendix B to 10 CFR 20. See Special Technical Specifications, Section S-2.5 for further details.

3.9.12 The average gaseous release rate over any 15-minute period shall not exceed 10 times the yearly average limit.

3.9.13 Following isolation and prior to release of gaseous wastes from the waste gas decay tanks, the contents shall be sampled and analyzed to determine compliance with 3.9.11 and 3.9.12.

3.9.14 For purposes of calculating permissible releases by the above formula, MPC for halogens and particulates with half-lives longer than 8 days will be divided by a factor of 35 from their listed values in 10 CFR 20, Appendix B.

3.9.15 During release of gaseous wastes to the plant vent stack, the following conditions shall be met:

a. At least one main exhaust fan shall be in operation.

b. The gaseous radioactivity monitor and the particulate monitor shall be in operation during discharges with the exception that if RIA-113 is down for maintenance, sampling of the stack effluent shall be taken every four hours and each sample analyzed.

3.9.16 During power operation, whenever the air ejector discharge monitor is inoperable, samples shall be taken from the air ejector discharge and analyzed for gross radioactivity daily.

3.9.17 Gaseous radioactive waste shall have the following minimum holdup times prior to release:

a. Potentially high-radioactivity gaseous waste collected by the waste gas surge tank - a minimum of 15 days up to 60 days if the concentration of xenon-133 exceeds the detection limit of 1×10^{-5} µCi/cc. No holdup required except as provided by the piping system itself if the concentrations of xenon-133 is less than the limit of 1×10^{-5} µCi/cc (except as noted in 3.9.17c).

b. Low-radioactivity gaseous waste collected by the gas collection header shown on FSAR Figure 11-3.
No holdup required except as provided by piping system itself.

c. Gaseous waste may be discharged from the waste gas surge tank through a high-efficiency filter directly to the stack for a period not to exceed 7 days if the holdup system equipment is not available and the release rates meet Specification 3.9.11.

3.9.18 It is expected that releases of radioactive materials in effluents shall be kept at small fractions of the limits specified in 20.106 of 10 CFR 20. At the same time the licensee is permitted the flexibility of operation, compatible with considerations of health and safety, to assure that the public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such small fractions, but still within the limits specified in 20.106 of 10 CFR 20.* It is expected that in

*See Special Technical Specifications attached.

using this operational flexibility under unusual operating conditions, the licensee shall exert its best efforts to keep levels of radioactive material in effluents as low as practicable.

Basis

Liquid wastes from the radioactive waste disposal system are diluted in the discharge mixing basin prior to release to the lake.(1) A minimum flow of 8,000 gpm is provided for dilution. The dilution can be achieved by use of any of the three service water pumps or either of the cooling tower blowdown dilution pumps or a combination of any or all of these pumps. Because of the low radioactivity levels in the mixing basin,the concentrations in the mixing basin will be calculated from the measured concentrations in the various water tanks, the flow rate from the waste tank and the discharge from the mixing basin. The flow rate in the mixing basin shall be determined by means of a flow meter or other suitable means.

Under normal operating conditions the expected release to the environment from the modified liquid waste systems shall be essentially zero. All modified waste system liquids will be recycled or prepared for shipment to an authorized disposal area or areas in accordance with applicable AEC and DOT rules and regulations, if specification 3.9.1 cannot be met.

The only releases to the environment will occur from the laundry wastes. The concentration of these wastes released shall be limited to 2.5×10^{-8} µCi/cc in accordance with the Special Technical Specifications, Section S-2.

If the annual average concentration of liquid wastes in the mixing basin equals 2.5×10^{-8} µCi/cc as specified, the potential dose to the general public from laundry wastes has been estimated using 61,300 gpm total diluted blowdown prior to release to the lake and a dilution factor of 1000[(2)] prior to the postulated consumption of water or uptake by fish. The radionuclide concentration is assumed to consist of I-131, Sr-90 and Cs-137 in the same relative abundance as in the primary coolant. It is also assumed that the person drinks water at a rate of 2,200 cc/day[3] and eats 50 grams of fish/day[4]. Based on these assumptions the potential annual dose to an individual from drinking water taken from the nearest public water supply at South Haven, Michigan, would be a total of 1.6×10^{-4} mrem/yr which results in an insignificant exposure to members of the public as a result of consumption of drinking water taken from the lake. If the annual average concentration of liquid wastes in the discharge were to equal MPC, the average concentration at the intake of the nearest public water supply at South Haven, would be well below MPC.[2,5] Under abnormal operating conditions, such as (but not limited to) steam generator tube leakages, fire, or pipe breakage, radioactive materials will be discharged to the environment after processing to reduce the discharged radioactivity to levels which are as low as practicable, and in any event in accordance with Special Technical Specifications, Section S-2.2.

The release limit of liquid wastes in the mixing basin is a selection based upon reasonable operating experience and shall still result in a concentration at the nearest public water intake significantly below MPC.[2] It is intended that the liquid waste release limit of Specification 3.9.2 normally be restricted to single batches of waste. The maximum amount of tritium in the discharge is limited to the value given in 10 CFR Part 20 by imposing a limit on the tritium concentration in the primary coolant water based on a minimum dilution of 8,000 gpm. As there is no mechanism for concentrating tritium above the concentration in the primary coolant system, there is no safety requirement to monitor the liquid waste discharge for tritium.

Prior to release to the atmosphere, gaseous wastes from the radioactive waste disposal system are mixed with the plant ventilation flow from at least one of two main (60,000 cfm) exhaust fans.[6] Further dispersion then occurs in the atmosphere.

3.9 EFFLUENT RELEASE (Contd)

If the activity level in the waste gas surge tank is greater than 1×10^{-5} μCi/cc, the potentially high-radioactivity gaseous waste will be stored in the waste gas decay tanks for up to 60 days to reduce the release of radioactive gas to the environs to as low as practicable in accordance with 10 CFR Part 50 limits. If the activity is less than 1×10^{-5} μCi/cc, the gaseous waste can be stored in the holdup tanks. A high radiation monitor shall signal to automatically close the waste gas decay tank discharge valve when the release rate exceeds that specified in Specifications 3.9.11 or 3.9.12. Provisions are made to bypass the holdup tanks for a period up to 7 days to effect required repairs and testing of the system and to allow discharge of collected gases during heating and startup. If the gaseous waste cannot be released at levels within the requirements of 10 CFR 20, Appendix B, the reactor shall be placed in a hot shutdown condition in order to eliminate the production of fission gases.

Holdup of a waste gas decay tank shall be considered accomplished if the tank remains isolated over the required time period and leakage from the tank does not cause greater than a 10 psi pressure drop.

The 15-minute limitation on gaseous release rates in excess of 10 times the annual average limit is based on the fact that radioactivity approximately equivalent to 5% of the annual allowable dose at the site boundary could be released in 15 minutes if the radioactivity level in the primary coolant approached the maximum allowable by Specification 3.1.4.

The low-radioactivity levels associated with the gaseous waste collected by the gas collection header allow it to be piped directly to the base of the plant ventilation tank.

The reduction in allowable release rate for particulates and halogens of 35 includes the value of 243 for I-131 as given in Regulatory Guide 1.42 plus credit for a six month grazing period and the ratio of the χ/Q value at the site boundary to that at the location of the nearest actual cow 1.5 miles southeast of the plant.

From the FSAR analyses,[7] the following long-term values can be obtained:

Wind Direction	$\frac{Xf}{Q}\ \frac{sec}{m^3}$	$\frac{Q}{Xf}\ \frac{m^3}{sec}$
N	2×10^{-6}	5×10^{5}
NNE	5.64×10^{-7}	1.77×10^{6}
SSW	7.39×10^{-7}	1.35×10^{6}
SW	5.23×10^{-7}	1.91×10^{6}
WSW	3.91×10^{-7}	2.56×10^{6}
W	3.88×10^{-7}	2.58×10^{6}
WNW	2.82×10^{-7}	3.54×10^{6}
NW	3.30×10^{-7}	3.03×10^{6}
NNW	5.22×10^{-7}	1.92×10^{6}

Therefore, the highest long-term value of χ/Q at the site boundary is seen to be 2×10^{-6} sec/m^3 or 2×10^{-12} sec/cc.

The limits for the concentration of residual chlorine in the circulating water discharge are conservatively consistent with the Michigan Water Resources Commission Order of Determination for the Palisades Plant.

Chlorination of the recirculating water system will be performed intermittently to limit algae growth. Chlorine residual levels allowed are well below the limits recommended by the EPA in the Final Environmental Statement.[8] Chlorine residual levels will be determined by the amperometric titration method to assure releases are not greater than 0.02 ppm.

REFERENCES

1. Special Report No. 5 dated December 1, 1972.
2. FSAR Amendment No. 15, question 2.3.
3. ICRP Standard Man Model.
4. US Bureau of Commercial Fisheries Statistical Digest No. 60, 1968.
5. FSAR, Section 2.2.2.
6. FSAR, Section 9, Figure 9.15.
7. FSAR, Appendix D.
8. Final Environmental Statement, Palisades Plant, June 1972.

4.11 ENVIRONMENTAL MONITORING PROGRAM (contd)

Applicability

Applies to routine testing of plant environs and to an analytical evaluation of the data collected from the environmental monitoring survey carried out.

Objective

To establish a sampling and surveillance schedule which will assure recognition of changes in the environs due to plant operations and assure that effluent releases are kept as low as practicable and within Federal and State limits.

Specifications

4.11.1 Radiological environmental samples(1) shall be taken according to the following schedule:

Table 4.11.1

Specific Samples and Collection Frequency

	Sample Class	Collection Frequency	Amount To Be Collected (Operational)
(a)	Air	Weekly	12
(b)	Lake Water	Monthly	2
(c)	Well Water	Monthly when available	3
(d)	Milk	Monthly when available	4
(e)	Organic	Monthly in Season	Crops and Fish As Desired
(f)	Film or TLD	Monthly	21
(g)	Lake Bottom Sediment	Twice per Year	4

4.11.2 The sensitivities listed below and in Table 4.11.2 shall be used for the samples listed in Table 4.11.1.

Air - When a gross beta count reveals radioactivity levels in excess of 1×10^{-12} µCi/ml, gamma spectrum analysis will be performed with the exception of I-131. An I-131 analysis will be performed on all air samples.

4.11 ENVIRONMENTAL MONITORING PROGRAM (Contd)

Water - When a gross beta count reveals radioactivity in excess of 1×10^{-8} μCi/ml, gamma spectrum analysis will be performed with the following exception; tritium analyses will be performed on all Lake Michigan water samples.

4.11.3 Plant equipment shall be used in conjunction with developed operating procedures to maintain surveillance of radioactive gaseous and liquid effluents produced during normal reactor operations and expected operational occurrences in an effort to maintain radioactive releases to unrestricted areas as low as practicable.

4.11.4 A report shall be submitted to the Commission at the end of each six-month period of operation as required under Section 6.6.5. If quantities of radioactive material released during the reporting period are unusual for normal reactor operations, including expected operational occurrences, the report shall cover this specifically. On the basis of such reports and any additional information the Commission may obtain from the licensee or others, the Commission may from time to time require the licensee to take such action as the Commission deems appropriate.

4.11.5 After the conversion to a closed-cycle cooling system utilizing evaporative cooling towers, aquatic samples shall be taken according to the following schedule:

	Sample	Frequency	Objective
(a)	Makeup and Dilution Water Temperature	Continuous During Operation	To determine ambient lake temperature conditions offshore of the plant.
(b)	Blowdown Water Temperature	Continuous During Blowdown	To determine increase in discharge water temperature over dilution water intake temperature.
(c)	Plume Temperature	At Least Once During First Year of Operation with Cooling Towers	To determine size of plume isotherms for compliance with water quality standards.
(d)	Makeup and Blowdown Water Flow	Continuous During Operation	To determine rates of plant water intake and discharge.

4.11 ENVIRONMENTAL MONITORING PROGRAM (Contd)

Sample	Frequency	Objective
(e) Blowdown Conductivity or TDS	Daily During Blowdown	To determine concentration of dissolved salts in discharge.
(f) Blowdown Total Residual Chlorine	After Chlorination	To determine that reactive Cl concentration in discharge is insignificant.
(g) pH	Daily During Blowdown	To determine that pH is within the permissible limits.
(h) Heavy Metals (Mn)	Daily During Suspected Discharge	To determine that release of toxic compounds is minimal.
(i) Fish on Intake Screen	Weekly During Operation	To obtain representative number, sizes and species of fish entrained by the intake flow.
(j) Fish in Discharge	During and After Chlorination	To identify gross effects on fish populations residing in the vicinity of the discharge.

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4.11.6 A meteorological monitoring program[2] shall be conducted in the vicinity of the plant site for at least two years after conversion to cooling towers to document effects of cooling tower operation on meteorological variables. Data on the following meteorological variables shall be obtained from the station network shown in Figure 4.11.1: Precipitation, temperature, humidity, solar radiation, downcoming radiation, icing conditions, visibility, wind direction and wind speed. In addition, studies shall be conducted for at least two years to measure effects of cooling tower drift on vegetation by associated salt deposition, icing or other causes.[3] Observations shall be made of a series of sample vegetation plots, and chemical analyses shall be made of representative samples of vegetation, soil and collected moisture to establish relative amounts of drift at various locations and influences on plant life. The incidence of icing and fogging on nearby transportation arteries shall be determined. Noise measurements shall be taken with and without the cooling tower in operation at different locations on site and around the surrounding areas. The study program to assess the meteorological and terrestrial effects of cooling tower operation onsite and offsite shall be carried out as follows:

METEOROLOGICAL STUDY

Sample	Frequency	Objective
(a) Precipitation	Continuously	To determine if the c.t.* influence natural precipitation processes.
(b) Temperature	Continuously	To establish c.t.* plume influences on temperature, if any.
(c) Relative Humidity	Continuously	To determine if the c.t.* plume produces an increase in R.H.
(d) Total solar Radiation	Continuously	To determine if the c.t.* plume inhibit total solar radiation.
(e) Total solar plus atmospheric radiation	Continuously	To determine the presence of nocturnal c.t.* plumes.
(f) Visibility	Continuously	To detect the presence of fog.
(g) Wind direction	Continuously	To determine the direction of movement to the c.t.* plume and alterations in wind patterns.
(h) Wind speed	Continuously	To determine if the c.t.* plume affect local wind speeds.
(i) Icing	During Winter Months	To determine if c.t.* plume creates icing problems on nearby highways and roads.

DRIFT STUDY

Sample	Frequency	Objective
(a) Precipitation collected and analyzed for $SO_4^{=}$ and Ca^{++}	Monthly	To establish pattern and rate of drift deposited ions.
(c) Analysis of vegetational composition	3 times per year (Spring, Summer, Fall)	To determine if c.t.* drift is altering the vegetational composition.

*c.t. = cooling towers

4.11 ENVIRONMENTAL MONITORING PROGRAM (Contd)

	Sample	Frequency	Objective
(c)	Vegetational chemical analysis	Yearly	To determine if drift deposited elements are concentrating in vegetation
(d)	Soil chemical analysis	Yearly	To determine if drift deposited elements are concentrating in soils.
(e)	Icing	Winter months	To determine if c.t. drift (ice) is physically damaging to vegetation.

4.11.7 A report shall be submitted to the Commission at the end of each six-months' period of operation as required under Section 6.6.5 and shall include documentation of the results of the terrestrial and meteorological study programs. The report shall also cover any unusual environmental effects specifically related to the aquatic study program.

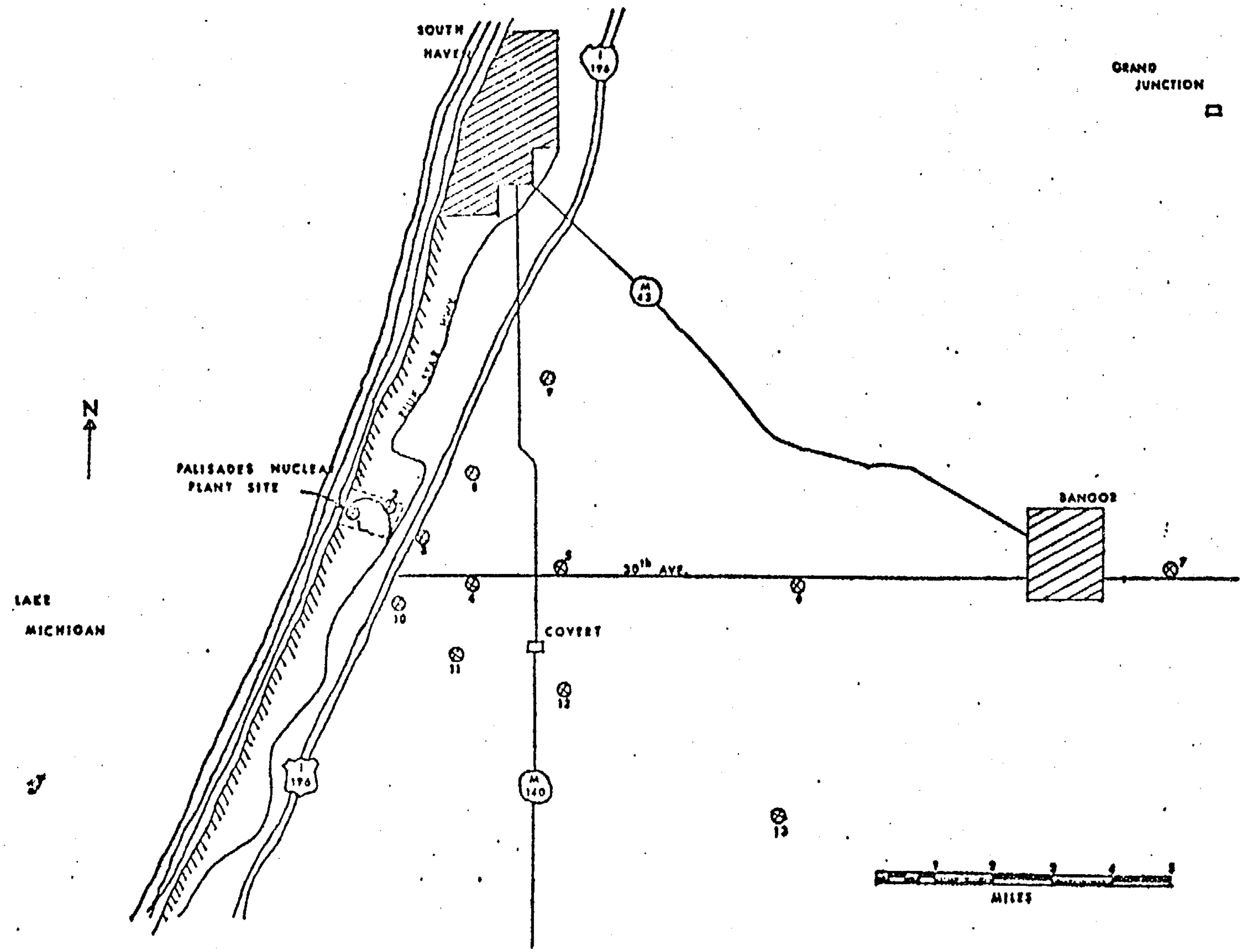

Figure 4-11.1 Locations of climatological stations

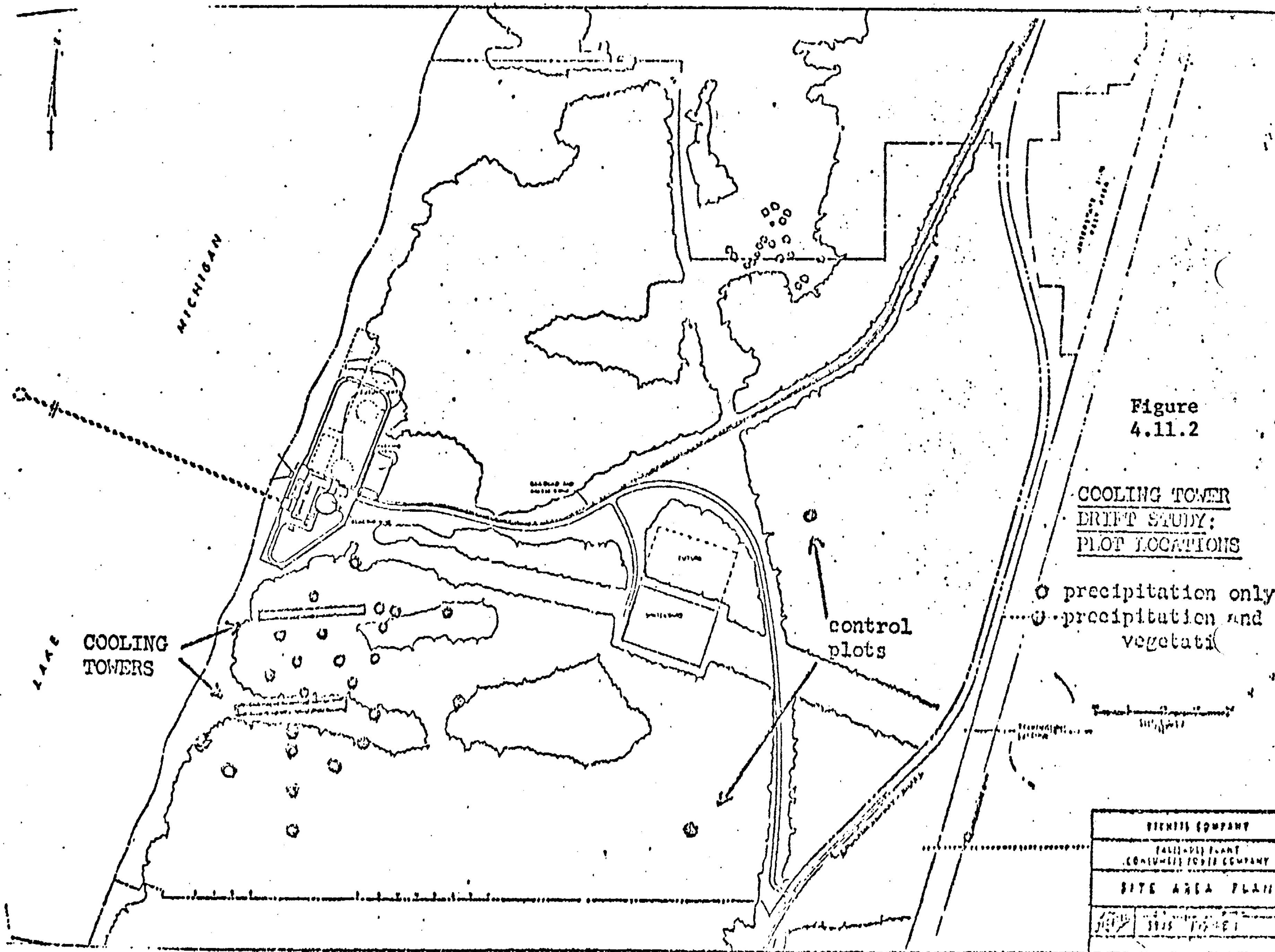

Figure 4.11.2

COOLING TOWER DRIFT STUDY: PLOT LOCATIONS

4.11 ENVIRONMENTAL MONITORING PROGRAM (Contd)

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Basis - Radiological

The radiological environmental monitoring program for the plant is designed to meet the following objectives:

1. Measurement of radiation levels in the sampled media is done in such a manner to assure compliance with 10 CFR 20 and Special Technical Specifications.
2. Survey design is such that releases of plant origin can be differentiated from natural or other sources of environmental radiation. This is accomplished in two ways. First of all, the commonly called "reference area approach to environmental surveillance" is used. This makes use of a calculation that shows whether or not a statistical difference exists between the levels of radioactivity detected near the site and those detected remote from the site. Secondly, specific isotopic analyses are performed. In this manner, concentrations of specific isotopes in the sampled environmental media can be related to known plant releases of the same nuclide.
3. Dose estimates to man are made if significant increases in radiation levels have been found to occur as a result of (2) above. This is meaningfully done by (a) requiring detection sensitivity to be far below any effective maximum permissible concentration, and (b) planning the survey with sample collection designed to estimate dose.

The survey consists of 12 stations. Nine are near and three are remote from the site. In addition, nine extra film-TLD stations are located at the site boundary and lake water, biota and bottom sediment are further collected at the site. In this way, inhalation, ingestion and direct dose can be estimated and because of the Lake Michigan sampling, food-chain parameters can be determined.

Meeting the objective of providing assurance that the facility's contribution to the naturally existing radioactivity in the environment is negligible requires analyses to be performed such that sensitivities are far below those resulting in maximum permissible dose (MPD) to man. In other words, levels of radioactivity in water, air or food to be detected shall be far below those resulting in MPD to man. Levels of radioactivity in water, air or food to be detected shall be a small fraction of any effective maximum permissible concentration (MPC) allowed in such a sample. This is sometimes called the absolute contribution approach. On the other hand, there is a level of release to the environment with a resultant corresponding level in food, air and water below which it is absurd to perform any specific isotopic analyses. Consequently, the sensitivities outlined in Table 4.11.2 are a compromise between the preceding two requirements. This schedule will insure that changes in the environmental radioactivity can be detected. The materials which first show changes in radioactivity are sampled most frequently. Those which are less affected by transient changes but show long-term accumulations are sampled less frequently. After a few years of operation, it is desirable to review the established limits. Data on the actual concentrations in food or other organisms (if any are observed) will permit this reevaluation.

The lake bottom sediment samples taken twice during the summer months will be sufficient to detect any buildup in Cs-137.

The gross beta limit on 1×10^{-12} μCi/cc on air samples represents 1% of the MPC, as given in 10 CFR Part 20, for unknown mixtures of gamma-emitting nuclides.

Basis - Nonradiological

1. Aquatic

   Continuous monitoring of plant intake and discharge temperatures, with consideration of rate of flow, is necessary to insure that the maximum increase in discharge temperature above ambient, after mixing of the blowdown with the dilution flow, does not exceed 5F°. At least one thermal plume survey shall be taken to assure that thermal discharges are in compliance with the State of Michigan water quality standards and Special Technical Specifications, Section S-1. The results shall be compared with those obtained from operation with once-through cooling. The thermal plume measurements will give a reasonably accurate indication of the area of lake surface, depth and shoreline area that might be affected by temperature changes of the cooling tower operation compared with the previous once-through cooling operation. Accurate temperature data regarding the temperature ranges, distribution, and size of the thermal plume will provide valuable information for determining thermal effects, if any, upon the biota in the area. Actual temperature measurement of the plume shall be periodically determined to assure compliance with the monthly maximum temperature limits. Measurements of conductivity or TDS of the blowdown will document the increased concentrations of salts and insure that, after dilution, the levels are not increased to levels that could potentially affect aquatic life.

Chlorine is added to recirculating water flow through the condensers and cooling tower to control slime and algae growth. This compound could be potentially toxic to resident aquatic life if discharged directly to the lake at the concentrations employed in the system. To guard against possible damage to aquatic life by blowdown during chlorination, the licensee can curtail blowdown until residual chlorine concentrations in the circulating water are such that discharges will be well within specified limits. Monitoring of chlorine concentration is necessary for this purpose. Amperometric method will provide a sensitivity of ± 0.1 ppm. Sulfuric acid is used to reduce scaling on the cooling towers. The spent acid converted to sulfate ion is diluted in the discharge mixing basin to assure a minimal change of 0.5 pH unit in the ambient water. The licensee will also monitor the pH of the blowdown to assure no bulk amounts of acids will be discharged. Although no heavy metals will normally be used in the cooling tower operation, the licensee may use potassium permanganate to recharge the sand filters for the makeup water in the plant. Thus, periodic samples shall be taken from the plant releases to monitor the amount of this metal discharge. Any other corrosion inhibitor or other heavy metal that may be needed occasionally for plant operation should also be monitored to minimize toxic effects on biota.

While the conversion of the cooling system to cooling towers will result in a considerable reduction in plant intake water requirements, it can be expected that some fish will enter the intake and become trapped on the intake screens. Direct observation of fish removed from the screens will indicate the species and number of fish affected by the water intake. In addition, during the simultaneous chlorination and blowdown discharge, even at relatively much lower concentration levels than discharged previously, the licensee will be required to observe any gross effects of chlorination on fish populations residing in the immediate vicinity of the discharge and the effects recorded and reported in the Semi-Annual Operating Reports.

The frequencies and sampling stations shall be adhered to as closely as possible, weather conditions and plant operation permitting.

2. Meteorological and Terrestrial

Operation of the cooling towers will result in direct discharges of moisture-laden air that could affect various meteorological variables in the vicinity of the towers. Cooling tower drift and the associated salts might also directly affect vegetation. Observations and analyses of control vegetation plots and moisture patterns are necessary to document the extent of drift and to what extent vegetation is being affected. Details of the meteorological and terrestrial monitoring programs, including the types of measurements, the sampling method, the frequency and duration and location of the sampling stations, including maps have been provided by the licensee.

Deleted

References

(1) FSAR, Section 2.5.

(2) "An Investigation of the Meteorological Impact of Mechanical Draft Cooling Towers at the Palisades Plant," First Annual Progress Report, The University of Michigan, May 1973.

(3) "Plan to Study the Effects of Cooling Tower Drift on the Terrestrial Vegetation at the Palisades Plant," John J. Rochow, Consumers Power Company, April 1973.

United States Atomic Energy Commission
Environmental Evaluation
Directorate of Licensing
Palisades Nuclear Generating Plant
Docket No. 50-255

INTRODUCTION

By letters dated September 23 and October 30, 1973, Consumers Power Company proposed two sets of changes (Section 4.11 Environmental Monitoring Program and Section 3.9 Effluent Release) to the Technical Specifications attached as Appendix A to the Facility Operating License DPR-20 for the Palisades Nuclear Generating Plant. These revisions are to provide for modifications of the original once-through cooling system to a closed-cycle cooling system, using two mechanical-draft cooling towers. See a schematic of the closed-cycle cooling system in the enclosed Figure 10.8. The licensee has also modified the radioactive waste treatment system as presented in detail in Special Report No. 5 "Palisades Plant Modification, Radioactive Waste, Circulating Water, Detailed System Description," December 1, 1972. The modifications have been previously described and evaluated in Amendment No. 21 to Consumers Power Company - Application for Reactor Construction Permit and Operating License, Docket No. 50-255, dated February 26, 1971, Amendment No. 24, on the Special Technical Specifications Pursuant to Agreement, dated June 17, 1971, and in the staff's Safety Evaluation Report (Supplement No. 3) issued June 11, 1971, and Final Environmental Statement issued June 1972. Changes in the Technical Specifications dealing with liquid and gaseous releases to the environment and in the aquatic monitoring and surveillance program appropriate to the changed mode of operation of the cooling and radioactive waste treatment systems are therefore necessary.

EVALUATION

The staff has reviewed the licensee's proposed changes in Appendix A and approves them, as discussed below along with additional revisions on the same subject. The staff has also taken into account the incorporation of the modified radioactive waste treatment system into the original radioactive waste treatment system. See Enclosure I for the two revised Sections 3.9 and 4.11 of the Technical Specifications.

A. Section 3.9 Effluent Releases

Certain parts of the subsections on "Applicability, Objectives, Specifications 3.9.6 through 3.9.10, Basis and References" provide for the release, dilution, and concentration limit for residual chlorine, and the conditions during chlorination of the once-through cooling system to minimize the environmental impacts on aquatic biota in Lake Michigan. Since November 20, 1971, the licensee has operated the once-through cooling

PALISADES PLANT

CLOSED CYCLE COOLING SYSTEM

REF: P&ID M-653 (Fig 10-5)

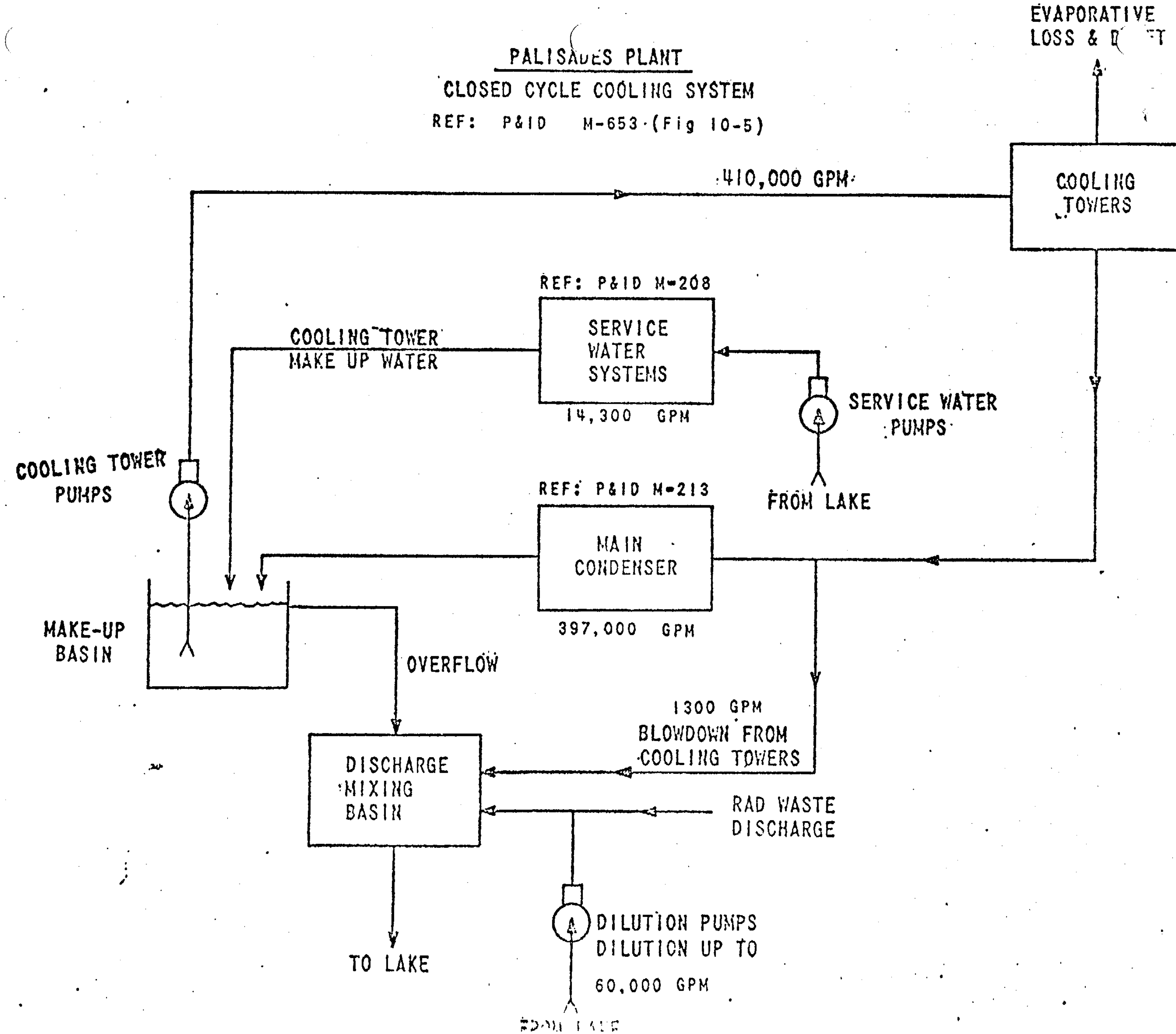

FIG 10-8

system using two circulating pumps of 390,000 gpm capacity and chlorinated the condenser to a maximum of one hour per month at a maximum release concentration of 0.5 ppm. In Specification 3.9.4(a), liquid radioactive wastes have also been diluted by use of at least one condenser circulating water pump in operation. As discussed in the licensee's Final Safety Analysis Report and Environmental Report and supplements and the staff's Safety Analysis Report, Final Environmental Statement of 1972, on March 12, 1971 the licensee agreed in a settlement agreement with the intervenors to convert to operation with a closed-cycle cooling system starting about the beginning of 1974 and with a modified radioactive waste system starting in the Spring of 1973. This agreement is provided as Special Technical Specifications attached to the Facility Operating License DPR-20 issued on October 16, 1972.

Liquid Radioactive Discharges

As discussed on pp. III-38 to III-42 in the FES, the modifications of the liquid radioactive waste treatment system, which includes installation of two evaporators, will reduce the liquid radioactive releases, except for the laundry waste discharges, to background levels (or "essentially zero" levels) during normal operating conditions. All liquid radioactive wastes will be recycled or prepared for shipment as solid radioactive waste in accordance with applicable Federal regulations and will be shipped to a Federally-licensed disposal area. Under abnormal operating conditions, releases from the radwaste system may be released to the environment but shall not exceed 10% of 10 CFR Part 20 limits averaged quarterly and they may not exceed 10% of 10 CFR Part 20 limits for any 60-day period. See Section S-2 of the Special Technical Specifications. The modified radioactive waste treatment system has been integrated into the original waste treatment system and the initial use of the system for processing the liquid wastes commenced September 5, 1973.

Laundry Wastes

All liquid effluent from the onsite laundry is collected in the laundry drain tank where a sample is taken and the liquid filtered. The liquid will be processed though the dirty waste system unless it contains materials which cannot be so processed without the possibility of impairing the function of dirty waste system equipment. The radioactive material in the laundry waste discharge which cannot be so treated may be released to Lake Michigan at levels not exceeding 2.5×10^{-8} μCi/cc on an annual average basis. The laundry wastes are expected to be a minor source of radioactivity, since contaminated clothing may be disposed of as solid waste. Treatment of laundry waste will not be affected by modification of the radioactive waste system. The limit of 2.5×10^{-8} µCi/cc, or 25% of the maximum permissible concentrations of 1×10^{-7} µCi/cc for unidentified isotopes in 10 CFR Part 20, Appendix B, Table II, is the expected maximum radioactivity concentration discharged from the plant during normal operation. Release of laundry waste to the environment is expected to total 0.03 Ci/yr. See Special Technical Specification, Section S-2 for further details.

Dilution of Liquid Wastes

To implement the conversion from once-through cooling to closed-cycle cooling, the licensee has removed the two large circulating cooling water pumps from the intake structure during the plant outage since mid-August 1973. For design details see Figures 10-5 through 10-7 of the Special Report No. 5. During plant outage, radioactive liquid effluents, primarily low-level laundry wastes, have been diluted by a minimum flow of 8,000 gpm using three service water pumps or two cooling tower blowdown dilution pumps of 30,000 gpm capacity each or a combination thereof. The proposed minimum dilution flow rate is based on minimum pump operating conditions when the plant is shut down. During plant operation, a total dilution flow rate of 60,000 gpm plus 1,300 gpm blowdown will be available. The minimum flow provides for flexibility of operation during plant operation or shutdown conditions.

Neither the existing nor the modified closed-cycle cooling system perform any essential safety-related function. However, the service water system does have important safety related functions. The design criteria for the modifications in the once-through cooling system require that the service water system be changed as little as practicable and that a continuous cooling water supply from Lake Michigan be provided for safety-related functions without relying on the condenser cooling water system. During the changeover to connect the cooling towers into the plant, the service water discharge was piped directly to the end of the discharge canal. Temporary piping modifications had been made such that any liquid radioactive wastes were injected into the service water stream upstream of the service water discharge monitor. Additional monitoring was provided by the existing radioactive waste treatment system monitor and a temporarily installed gross radioactive liquids discharge monitor. Once the cooling towers are operational, during normal operation the service water discharge will be used as makeup water for the cooling towers instead of being returned to the lake. An alternate flow back to the lake has been provided during shutdown or emergencies.

According to Figure 10-8, any radioactive wastes released will be collected in the discharge mixing basin after being monitored, diluted with lake water and cooling tower blowdown, and discharged over a weir into the discharge canal. Because of the low radioactivity levels in the discharge canal, the concentrations in the canal will be calculated from the measured concentrations in the waste tank, the flow rate from the waste tank and discharge flow in the mixing basin. The flow in the discharge canal will be determined by a flowmeter or by other suitable means. The discharges shall be monitored in accordance with the General Design Criterion 64 of Appendix A to 10 CFR Part 50 and the guidelines of Regulatory Guide 1.21. In addition, the concentration of radioactive wastes discharged to the lake will continue to be governed by limits presently indicated in the Technical Specifications and the Special Technical Specifications, Section S-2.

Because of the low radioactivity levels in the release from the laundry wastes during the interim period of the changeover to the cooling towers and after cooling tower operation begins, the average concentrations at the intake of the nearest public water supply at South Haven, Michigan would be well below the maximum concentrations of 10 CFR Part 20. The estimated whole body dose to the individual from consumption of water from the South Haven water supply is about 10^{-4} mrem/yr. Therefore, the discharge of liquid wastes at the specified annual average concentrations will not result in significant exposure to members of the public as a result of consumption of drinking water from the lake, even if the effects of potable water treatment system on reducing radioactive concentrations of the water supply were neglected.

Gaseous Radioactive Discharges

As described on p. III-37 of the FES, the licensee has increased the capacity of the existing gaseous waste system with three additional waste decay tanks (225 cubic feet each). This modification provides for a capability to retain high activity waste for periods up to 60 days. Thus all high activity waste will be collected in the gas decay tanks, sampled and analyzed. If the concentration of xenon-133 exceeds the detection limit of 1×10^{-5} μCi/cc, the contents will be held up for 60 days to permit decay of the principal radioactive noble gases except krypton-85. If the radioactivity greater than 1×10^{-5} μCi/cc is not detected, the waste gas surge tank can be discharged through a high-efficiency filter directly to the ventilation stack. According to Table III-7 in the FES, the staff estimated that a reduction from 4,180 Ci/yr to 3,214 Ci/yr of the anticipated gaseous radioactivity released from the plant will result from the modified gaseous radwaste system. Under expected operating conditions with a maximum of 0.1% defective fuel and assuming continuous operation and full power, the licensee estimates that 375 Ci/yr of radioactivity (primarily Kr-85) will be released, resulting in the maximum skin plus whole body dose to an individual at the site boundary of 0.073 mrem/yr (Special Report No. 5, p. 1-17).

This is equivalent to a dose to the population within a 50-mile radius of the plant of 0.64 man-rem/yr.

Thermal Discharges

In terms of thermal discharges, the modified circulating water system is designed as a closed-cycle cooling system except for the 1,300 gpm blowdown discharged into the lake and the 12,000 gpm (summer) or 9,000 gpm (winter) of water evaporated as a plume from the cooling towers. The 1,300 gpm blowdown water flow is further diluted in a discharge mixing basin by 60,000 gpm of Lake Michigan water such that the temperature of the diluted water flow discharged to the lake shall not exceed the ambient temperature of the receiving water at the shoreline by more than 5F°. The discharge flows from the discharge mixing basin over a weir into the surface discharge canal and then from the shoreline at a low velocity in order to maximize dissipation of heat from the blowdown to the atmosphere. The heat rejection to the lake from the diluted blowdown shall not exceed 0.5 billion British thermal units per hour (BBtu/hr). In addition, in regards to the State of Michigan water quality standards, Lake Michigan shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3F° above the existing natural water temperature. Lake Michigan shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures in °F higher than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	55	60	70	80	80	80	65	60	50

The cooling tower system was designed for a 30°F range and has two cooling tower water pumps, each rated for 205,000 gpm which includes allowance for the maximum expected blowdown, drift, and evaporation. Each tower has 18 cells.

Chemical Discharges

Chemicals that will be used during the cooling tower operation will include 8% solution of sodium hypochlorite and concentrated sulfuric acid. Chemical discharges from the cooling water system will originate from four sources: (a) concentration of chemicals in lake water by evaporation; (b) neutralization of makeup water with sulfuric acid; (c) chlorination of cooling water; and (d) chlorination of service water. The sodium hypochlorite yielding chlorine controls algae and slime in the cooling system, and the sulfuric acid controls pH, scaling and corrosion of condenser tubes.

Since sulfuric acid is added to the makeup water because of basic salts and carbon dioxide in the lake water, all discharges will be analyzed for hydrogen ion concentration to assure no bulk amount of acids will be released. Thus the licensee will be required to monitor the pH of all discharges such that a range from pH 6.5-8.8 with a maximum artificially-induced variation of 0.5 pH units within this range shall not be exceeded in accordance with the State of Michigan water quality standards. The acid treatment is described on pages 2-6 to 2-8 in Special Report No. 5. The amount of H_2SO_4 required is about 88 ppm, which will result in adding about 86 ppm $SO_4^=$ to the water. Since the salts dissolved in the blowdown water are concentrated by a factor of about 10 times above the original concentrations in the makeup water because of evaporation, the sulfate concentration will be increased to 860 ppm $SO_4^=$. However, the concentration is reduced to 18.6 ppm by the dilution water of 60,000 gpm. Similarly, other naturally occurring chemicals such as carbon dioxide will be increased in concentration by about 20% because of evaporation in the cooling tower as indicated in Table 2.1 in Special Report No. 5. None are expected to cause any toxic effects on aquatic biota except residual chlorine.

As described on p. III-50 of the FES, chlorination is expected to occur about one hour per day in which the circulating cooling water will be chlorinated up to 1 to 2 ppm free chlorine. The chlorinated blowdown water will be secured during and after chlorination such as to allow the chlorine to decompose to the chloride ion due to exposure to light and air. The concentration of free chlorine in the discharged blowdown will be reduced to essentially zero. Chlorination will result in a discharge of 0.022 ppm maximum free chlorine and 0.087 ppm of chloride ion which are expected to be released from the circulating closed-cycle cooling water blowdown. The service water system will require chlorination of about 0.5 hr/month to the extent of a maximum concentration of 0.5 ppm free chlorine. The added chlorine concentration after dilution will amount to about 0.0005 ppm free chlorine residuals entering the lake. See Table III-10 in the FES for additional information.

Although the licensee requested deletion of Specification 3.1.10, the staff believes that, even with the low concentration of free chlorine expected to be released, since chlorination will be required on a daily basis and free chlorine will be discharged daily in the blowdown, proper precautions should be taken in the event that insufficient time has been allowed to holdup the chlorinated blowdown to permit decomposition to occur prior to discharge. The licensee can easily observe if any fish are in distress in the plume during discharge of the chlorinated blowdown.

B. Section 4.11 Environmental Monitoring Program

On September 28, 1973, the licensee requested changes in the environmental monitoring program because of the change in the cooling system mode of operation. The staff has reviewed the request and requires modifications to the licensee's requested change as discussed below.

In subsection 4.11.5 a detailed aquatic study program has been carried out for the purpose of assuring that thermal and chemical discharges were kept within allowable limits during operation of the once-through cooling system. The conversion of the once-through to a closed-cycle cooling system will result in reducing the effort expended on the aquatic monitoring program and increasing the effort on a terrestrial and meteorological monitoring program.

In reference to thermal discharges, to assure that the increase in temperature of the diluted blowdown does not exceed 5F° at the shoreline and the temperature of the blowdown complies with the State of Michigan water quality standards, temperature measurements of the cooling water makeup prior to mixing in the makeup mixing basin, dilution water prior to mixing in the discharge mixing basin, and the blowdown water shall be recorded daily with sensors with a sensitivity of $\pm 0.5°$.

In the event one of the cooling tower blowdown dilution pumps is out of service, the temperature measurements shall be recorded continuously. In the event the increase in temperature exceeds the maximum limit of 5F° for the temperature differential of the blowdown water specified in Specification 3.9.9 by more than 20% for more than 12 hours, the temperature of the blowdown water shall be recorded continuously and the ΔT of the discharge water temperature over the dilution water intake temperature shall be determined hourly and the results reported in the Semi-Annual Operating Report. Action shall be initiated by the licensee to determine the cause of any temperature excess and the expected resolution of the condition. Appropriate corrective action, including power reduction, will be taken by the licensee if the limits specified in Specification 3.9.9 are exceeded for any period of more than 24 hours. Furthermore, the licensee shall notify the AEC of the problems and the course of action taken to resolve the problem.

During the first year of operation with the cooling towers, the thermal plume shall be mapped at least once to determine the temperatures and the size of the 5F° and 3F° excess temperature isotherms and the results correlated with those taken previously during once-through cooling operation. The information gathered should be incorporated as input data to thermal models and the thermal models used to predict the extent of the 3F° excess isotherm under varying seasonal conditions. The temperatures of the discharge shall also be measured to assure that the Michigan water quality standards will be met during each month of the year.

Water flows in the mixing basin shall be continuously determined by means of a flowmeter or by other suitable means and recorded daily during normal operation or continuously during times when the flow rate is changing because of maintenance or outage of any dilution pump. During discharge of radioactive and chemical releases in the blowdown the flow rate in the discharge mixing basin shall be measured and recorded to assure proper dilution of the discharges.

Monitoring of suspended and dissolved solids or salts in blowdown water or other plant discharges because of the concentration from evaporation by a factor of about 10 in the cooling tower circuit shall be performed on samples taken daily from the discharge mixing basin. Monitoring of the pH of the blowdown will be required to avoid discharges of excess acids such as sulfuric acid used in the treatment of the cooling tower system. Corrective action will be required to assure that the pH of the discharges will be kept within allowable limits. Monitoring of discharges of any heavy metals such as manganese from charging sand filters for filtering plant makeup water should be carried out.

With the anticipated daily use of chlorine compared to the monthly use in the once-through cooling system, the licensee must demonstrate the necessity for frequency of chlorination. Prior to adding the sodium hypochlorite solution to the closed-cycle cooling system, samples shall be taken biweekly during the first year of operation from the makeup water basin for the purpose of determining the chlorine demand. Samples shall be taken prior to dilution in the discharge mixing basin during and after chlorination, measuring the residual chlorine and calculating the dilution concentration. The licensee should use amperometric techniques to obtain the sensitivity of ± 0.1 ppm or less of residual chlorine. Records of chlorine addition, concentration measurements, procedures used, schedule for application of the chlorine, any tests performed to determine the minimum levels necessary for controlling algae growth, and the schedule of holding up the blowdown to allow for the residual chlorine to chemically decay prior to release shall be reported in the Semi-Annual Operating Reports.

<u>Biological Monitoring</u>

With the cooling tower operation as compared with the once-through cooling operation, the volume of water withdrawn by the plant is reduced by a factor of about 5.3. The reduction will assist in reducing impacts from entrainment and impingement of fish and other aquatic biota on the intake screens. However, the licensee will be required to monitor weekly the fish impingement on the intake screens. The licensee will record the number, size and species of fish impinged in the intake screens both at the intake structure for makeup water and the dilution water. The information will be reported in the Semi-Annual Operating Reports.

Meteorological and Terrestrial Monitoring

In subsection 4.11.6, the licensee plans to conduct a meteorological monitoring program to document the effects of cooling tower operation. The data that will be collected include precipitation, temperature, humidity, solar radiation, downcoming radiation, visibility, icing and fogging frequency, wind direction and wind speed. Studies also will include the effects of icing, fog and drift from the cooling tower plume on the local vegetation, soil, and nearby transportation arteries. Noise studies with mechanical draft cooling towers shall also be required.

The licensee provided two reports[1,2] on the anticipated meteorological impacts and the effects of cooling tower drift on the terrestrial vegetation. The licensee has been carrying out meteorological measurements before and will continue to do so during the operation of the cooling towers. Details of the type of climatological sampling devices used were provided in the University of Michigan report. A fog predicted model was also developed.

The licensee also plans to conduct studies for at least two years to measure effects of the cooling tower drift on vegetation by associated salt deposition, icing, or other causes. Observations shall be made of a series of sample vegetation plots, and chemical analysis will be made of representative samples of vegetation, soil, and collected moisture to establish relative amounts of drift at various locations and influences on plant life. The staff has recommended that total soluble salt deposition, including sulfate ion, be measured as a function of time at the proposed sampling stations. Concentrations of salts from the biocides used should be determined in the drift collectors.

The vegetation monitoring program should be supplemented by aerial and ground level photographs. In addition, an annual biological reconnaissance of the immediate area for visual effects from operation of the cooling towers should be included.

The licensee provided a specific meteorological and drift sampling program in its proposed technical specifications change in subsection 4.11.6.

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(1) "An Investigation of the Meteorological Impact of Mechanical Draft Cooling Towers at the Palisades Plant," First Annual Progress Report, The University of Michigan, May 1973.

(2) "Plan to Study the Effects of Cooling Tower Drift on the Terrestrial Vegetation at the Palisades Plant," John J. Rochow, Consumers Power Company, April 1973.

The sampling program includes objectives to the measurements to be made and the specifications as to the appropriate sampling type, frequency, schedule of duration of measurements, and location of sampling stations, including maps, to determine the effects of cooling tower operation in the local area. The staff also will require that after the two-year study on effects of cooling towers on the terrain is completed, the licensee reevaluate the program to determine the extent of any program that will need to be continued.

During the period of operation with cooling towers, the staff does not expect any significant effects of cooling towers based on the assessment carried out in the Final Environmental Statement in which it was found that effects from cooling towers should be minimal (p. iv of FES).

A report shall be submitted to the Commission at the end of each six months' period of operation as required under Section 6.6.5 and shall include documentation of the terrestrial and meteorological study program on the effects of cooling towers on the terrain. The report shall include any unusual environmental effects, specifically related to the aquatic, terrestrial, and meteorological study program. An evaluation of the comparative effects of the once-through cooling and the closed-cycle cooling on the environment should also be reported after the two-year study program is completed.

CONCLUSIONS

Based on the above discussion, the staff has concluded that these changes in Section 3.9 Effluent Release and Section 4.11 Environmental Monitoring Program as modified from those requested by the licensee do not significantly affect the quality of the environment and are approved for environmental considerations. Since safety related systems were involved in the technical specification changes, the staff originally prepared Supplement No. 3 to the Safety Evaluation Report, dated June 11, 1971, based on earlier details of the plant modifications and has since prepared the enclosed Safety Evaluation based on subsequent information on the final design of the plant modifications. The staff has concluded these changes in technical specifications do not present significant hazards consideration and there is reasonable assurance that the health and safety of the public will not be endangered.

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Date: August 30, 1974

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

SAFETY EVALUATION BY THE DIRECTORATE OF LICENSING

SUPPORTING AMENDMENT NO. 6 TO FACILITY OPERATING LICENSE NO. DPR-20

CHANGE NO. 10 TO APPENDIX A OF THE TECHNICAL SPECIFICATIONS

CONSUMERS POWER COMPANY

PALISADES NUCLEAR GENERATING PLANT

DOCKET NO. 50-255

MODIFICATION TO THE LIQUID RADWASTE SYSTEM

AND CONDENSER COOLING SYSTEM

Modifications to the Radwaste System

Consumers Power Company (CPC) has provided the capability for reducing the radioactivity in the liquid effluent discharges from the Palisades Plant, except for laundry wastes, to essentially background levels during normal operation and to a small fraction of the limits in 10 CFR Part 20 under abnormal conditions. This capability was achieved by modifications to the original Palisades Radwaste System that are described in Special Report No. 5 which was submitted by CPC by letter dated December 1, 1972, for our review. The staff's preliminary evaluation of the modifications to the Radwaste System is included in Supplement No. 3 to its Safety Evaluation of the Palisades Plant dated June 11, 1971, concluding that the proposed modifications will even further reduce the previously small release of radioactive effluents.

The modifications to the Radwaste System involve the addition of new components to the original system to facilitate additional processing, including evaporation of radioactive liquid wastes. The added components are listed in Table 1-2 in Special Report No. 5 and include new radwaste evaporators, additional storage tanks, and associated pumps, piping, valves, and fittings. Except for the new Primary System Makeup Storage Tank and the Utility Water Storage Tank which will not contain radioactive liquid wastes, all other new tanks and components are housed inside an addition to the Auxiliary Building. The new equipment meets Seismic Class 2 criteria. The Auxiliary Building addition meets Seismic Class 1 criteria, and is designed for loadings and for sustaining the impact of tornado generated missiles, previously accepted by the staff for the original Auxiliary Building.

CPC has also installed inside the Auxiliary Building addition three additional gas decay tanks to increase the capability for holdup of radioactive waste gases. The new tanks each have a capacity of 225 ft^3 and meet Seismic Class 1 criteria as do the three original gas decay tanks each with a 100 ft^3 capacity.

The capabilities of the modified Radwaste System for holdup and processing radioactive liquid effluents and for discharging liquid wastes as low as practicable are described in the Environmental Evaluation attached to Change No. 10.

All added components in the modified Radwaste System are housed within the Auxiliary Building addition. The arrangement of the equipment provides that any leakage or spillage of liquid waste would be collected by floor drains and sumps and would either flow to the waste receiver tank or be contained within the building.

The normal sources of radioactivity in liquid wastes are from corrosion and fission products in the primary coolant. The calculated primary coolant activity by isotopes for conditions after 40 years of operation with the originally assumed 1% defective fuel remains unchanged with the modified Radwaste System except for tritium. Because substantially all liquid wastes will be recycled, the tritium in the primary coolant will gradually build up during normal operation and would reach a concentration of 2.8 uCi/cc calculated by CPC, assuming a plant life of 40 years and zero primary coolant leakage. We find that this is an acceptable and conservative estimate for the assumed conditions.

CPC has evaluated the consequences of accidental releases of tritiated water. The maximum dose to the public would result if a rupture of the Safety Injection and Refueling Water Tank is assumed at the time it contains primary coolant with a maximum concentration of 2.8 uCi/cc for the postulated conditions described previously in this Safety Evaluation. It is further assumed that the entire coolant inventory from the ruptured tank is released to Lake Michigan. Our own calculations, using conservative assumptions, indicate a dose of 12 mrem to an individual consuming water from the nearest drinking water supply at South Haven. This is significantly below the allowable yearly dose of 500 mrem in 10 CFR Part 20.

We have also evaluated the potential consequences of a rupture of a new gas decay tank because of its larger capacity of 225 ft^3. The same conservative assumptions that we have previously used in the analysis of this accident involving the assumed rupture of an original tank with 100 ft^3 capacity have been applied to this evaluation. We find that the maximum doses of 2.4 rad at the exclusion boundary and 0.3 rad at the

LPZ distance that we have previously calculated remains unchanged. This conclusion is valid because the original specific assumption that all of the noble gases that would be contained in the entire volume of the primary coolant system after one day of decay are stored in the tank at the time of the accident is independent of the capacity of the tank that is postulated to fail.

Modifications to the Condenser Cooling System

The Palisades Plant condenser cooling water system has been modified from the once-through condenser cooling system to a closed system that will recycle heated main condenser cooling water through two mechanical draft cooling towers. The modifications have been completed during the maintenance outage that commenced August 11, 1973. The cooling towers will be placed into operation upon return of the plant to service.

The final design of the modifications to the condenser cooling system and minor changes to the service water system have been described in Consumers' Special Report No. 5 submitted by letter dated December 1, 1972, for our review. The submittal was supplemented by letter dated April 23, 1974. The staff's preliminary evaluation of the modifications to the condenser cooling system is included in Supplement No. 3 to its Safety Evaluation of the Palisades Plant dated June 11, 1971.

The modified closed cycle condenser cooling water system includes two mechanical draft cooling towers, two cooling tower pumps, two dilution pumps that will add lake water to the cooling tower blowdown before it is discharged to Lake Michigan, fire equipment and chemical treatment equipment.

Cooling water is recycled to the existing condensers by two new half-capacity wet pit cooling tower pumps which are installed in the cooling tower pump basins located inshore of the original discharge structure. After picking up heat in the condenser, the coolant flows through the original 96-inch discharge lines into the cooling tower pump basins. The circulating water from the pump basins is pumped back to the cooling water distribution header through two newly installed 96-inch pipes.

Cooling tower blowdown is extracted from the circulating water piping near the two condenser inlets to minimize discharge temperatures. The blowdown is discharged to the discharge mixing basin where it mixes with the water supplied by the two new dilution pumps that are installed in the original intake structure. Ample dilution water can be handled by the pumps for limiting the temperature rise in the receiving Lake Michigan water to 5°F.

The plant service water system discharge piping has been rerouted to the cooling tower makeup basin in the original discharge structure. Service water discharge is used for makeup of cooling tower circulating water that is lost during normal operation by drift, evaporation, and blowdown. The excess service water discharge passes over the overflow weirs into the discharge mixing basin, thence to Lake Michigan.

The modified condenser cooling system meets Seismic Class 3 requirements as did the original once-through condenser cooling system. The cooling towers conform to the latest Cooling Tower Institute (CTI) codes applicable at the time of detailed design, thus meeting the requirements of the Special Technical Specifications included in Appendix A to License No. DPR-20.

The closed cycle condenser cooling system, as was the original once-through system, is only required for heat removal in the plant turbine cycle and does not perform any essential safety related functions. Assuming a total loss of function of the condenser cooling system with consequent loss of condenser vacuum, a turbine trip would be initiated which in turn would result in a reactor scram from the reactor protection system. This occurrence does not involve an unreviewed safety question since it involves the same chain of events as previously evaluated.

The plant service water system does perform essential safety functions. However, only its discharge piping was modified for routing the service water discharge to the discharge makeup basin. The modified "critical portion" of the service water system meets Seismic Class 1 criteria. Cooling water for the cooling tower pump seals is supplied by the service water booster pump from the "non-critical" service water header. We have determined that any failure in this portion of the "non-critical" service water system would be isolated automatically and would not impair the essential safety related functions performed with the "critical" headers in the service water system.

The two mechanical draft cooling towers are located in the sand dunes due south and at distances of 500 feet and 1000 feet respectively from the plant. Because of location and distance, the integrity of safety related plant features would not be impaired assuming damage would occur to the cooling towers from any natural phenomenon.

The modified condenser cooling system is controlled from a separate panel in the control room. Electric power for controls and for powering the new pumps is furnished from busses that are not connected to essential safety related plant features. We have concluded that this separation in the controls and power supply is acceptable.

Conclusion

We have concluded, based on the reasons discussed above, that the authorization of this change does not involve a significant hazards consideration. We also conclude that there is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

for J. V. Wambach
Alfred Burger
Operating Reactors Branch #1
Directorate of Licensing

Robert A. Purple
Robert A. Purple, Chief
Operating Reactors Branch #1
Directorate of Licensing

Date: August 30, 1974

50-255

Amendments 6 and 7 never issued

(These amendments were called to the attention of the LA's.