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October 9, 1970

Re: Docket No. 50-255

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Morris:

I am transmitting herewith 150 copies of Consumers Power Company's Environmental Report, Operating License Stage, discussing environmental considerations relating to the Company's Palisades Plant. This Report is a revised and expanded version of the Report filed with the AEC on September 1, 1970.

This Report is being submitted in compliance with proposed Appendix D to Part 50 of the AEC's Regulations. You already have in hand copies of our updated application for the Palisades Plant, which we ask be circulated to other agencies, together with the Environmental Report.

Yours very truly,

J. L. Bacon

JLB/arn

MEMO . . . from . . . K. A. Swarts

Chris Henderson
USAEC
7920 Norfolk Ave.
Bethesda, Maryland
20014

Draft of comments for response to comments from agencies on our Palisades Environmental Report. Karl Goller asked that I send to you.

Ken S.

Rec'd Off. Dir. of Reg.
Date 3/27/71
Time 12:00

RESPONSE TO COMMENTS
ON THE ENVIRONMENTAL REPORT
PALISADES NUCLEAR PLANT

A. Introduction

Several comments on the Palisades Plant Environmental Report have been received from the United States Department of the Interior; the Department of Health, Education and Welfare; and the Assistant Secretary of Defense. Letters concerning the report have alos been received from the Department of Agriculture, Federal Power Commission, and the State of Michigan Department of Natural Resources. The last three letters did not contain specific comments.

Since a majority of the comments referred to the radioactivity and heat release to Lake Michigan and the subsequent effects on public health and the ecology, it should be emphasized at the outset that Consumers Power Company will make extensive modifications to the plant to alleviate some of the concerns in these areas. Although the Company firmly believes that the existing design of the radioactive waste system and the condensor cooling system are more than adequate to protect the health and safety of the public and the ecology, we will install a more extensive radioactive liquid waste processing system to maintain the radioactivity release as low as practicable and a closed cycle condenser cooling system employing cooling towers to minimize the heat release to the lake. A brief description of these systems are as follows:

1. Liquid Radioactive Waste Processing Systems Modifications

The modified radioactive waste processing system will be designed to collect, store, process, monitor and dispose of essentially all liquid radioactive wastes from the Palisades Plant. The integrated system will be basically comprised of three subsystems: clean waste, dirty waste and laundry.

The clean waste system processes high-activity, high-purity (low solids) liquid wastes collected from four basic sources: the letdown from the primary coolant system, the primary system drain tank, the radioactive-chemical laboratory drain tank and the equipment drain tank.

The letdown from the primary coolant system is the largest source of both radioactivity and liquid to the clean radwaste system. The main sources of this liquid are thermal expansion of the primary coolant system and dilution of the primary coolant for boron concentration control.

The primary system drain tank serves as a collection point in the containment building for seven sources of liquid: chemical and volume control system heat exchanger drains, reactor shield cooling drains, safety injection tank drains, primary coolant pump seal leakage, primary loop drains, quench tank drains and reactor flange leakage drains.

The radioactive chemical-laboratory drain tank serves as a collection point for the sample sink drains and the clean radioactive chemical-laboratory drains.

The equipment drain tank serves as a collection point for the spent resin shipping cask drains, radioactive steam generator blowdown, spent fuel pool heat exchanger drains, spent fuel pool drain, spent resin storage tank drains, charging pumps relief line and drains, chemical and volume control system ion exchangers and filter drains, volume control tank drains and waste gas surge tank drain.

The liquids from the primary system drain tank and the letdown pass through the vacuum degasifier where they are joined by the liquids from the radioactive chemical-laboratory drain tank and the equipment drain tank. These liquids are then collected and may be held up for natural decay in the clean waste receiver tanks. After sufficient decay the liquids are pumped out of the clean waste receiver tanks, through the clean waste filter, the radwaste ion-exchangers and the treated waste monitoring tanks to an evaporator. The evaporator will serve to further clean the demineralized liquids and to separate out the boric acid. The distillate from the evaporator will be stored in the primary coolant system make-up tank for reuse. The concentrate from the evaporator will be essentially pure boric acid and will be stored in the boric acid tank for further use or sent to the solid waste drumming station for packaging and eventual off-site disposal.

The dirty waste system collects low activity, high solids liquid from the engineered safeguards rooms, the volume control tank relief, access control area sink, emergency shower, containment

sump drains, vent stack drains, pump leak-off, decontamination pit drains, spent fuel cask wash-down drains, contaminated lab drains, boric acid area drains, component cooling loop drains, floor drains, treated waste monitor tank drains and the component cooling water surge tank. These liquids are collected in the dirty waste drain tank from which they are passed through the dirty waste filter to the filtered waste monitor tank. The filtered liquids will then be processed through an evaporator to further clean up the liquids and to separate out any boric acid or other solids. Like the clean waste distillate, the distillate from the dirty waste evaporator will be recycled for reuse in the plant. The concentrate will be reused as boric acid (if pure enough) or sent to the solid waste drumming station for packaging and eventual off-site disposal.

The laundry wastes consist of the used wash water from the plant laundry facility. This liquid may have picked up some solids from clothing and is, therefore, filtered to remove contaminates. The liquid will be processed through 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 radioactivity in the laundry waste which may be released to Lake Michigan shall not exceed 2.5×10^{-8} μCi/cc on an annual average basis.

In the event of abnormal plant operation, such as operating with steam generator tube leakage, the steam generator blowdown water containing radionuclides and chemicals will be processed through the

dirty waste evaporator. The distillate from the evaporator will be released to the lake and the concentrate will be sent to the solid waste drumming station for packaging and eventual off-site disposal. The radioactivity release to the lake during these abnormal conditions shall not exceed, on quarterly average bases, 10% of 10 CFR Part 20 limits. Operation under these conditions shall not be extended for longer than 60 days.

The modified radioactive waste processing system will be installed and placed in operation no later than the resumption of operation of the plant after its first scheduled refueling.

2. Closed Cycle Condenser Cooling Systems

The modified condenser cooling system shall be a closed cycle system in which the condenser cooling water is continually recycled, except for cooling system makeup water from and blowdown to Lake Michigan. The system shall include one or more wet-type cooling towers which may be of either the natural or the mechanical draft type.

To accommodate this closed circuit system, the existing cooling water intake structure will be modified so that the present lake inlet will go only to the service water pump bay. The existing service water pumps [redacted] will take suction from the cooling tower basin and from the lake, with the lake providing cooling tower makeup water. The existing circulating water pumps will be isolated from the lake inlet and instead will receive water from the cooling

tower basin and discharge to the condenser. New circulating water pumps will be installed to carry the condenser discharge flow to the cooling tower inlet. The circulating water will pass through the tower into the basin below and then on to the modified intake structure where it will again be pumped through the condenser using the existing circulating water pumps.

Some water must be discharged from the cooling tower basin to the lake in order to control the concentration of salts or other impurities which are contained in the lake makeup water. This discharge is termed the tower "blowdown." Dilution pumps will be installed to add lake water to the blowdown prior to discharge into the lake. The dilution water flow will be such that the temperature of the mixed dilution water and blowdown will not exceed the ambient temperature of the receiving water at the shoreline by more than 5°F. The design heat rejection to the Lake as a result of this discharge will be as low as practicable consistent with available equipment, Palisades Plant and Consumers Power electrical system operating requirements, design optimization and other condenser cooling system design objectives, and will in no event exceed 500,000,000 BTU/hr.

The modified system shall be placed in operation within about forty-two months following the initial startup of the plant.

The specific comments and Consumers Power Company's response to these comments are presented below:

B. United States Department of Interior

1. Comment:

The report should list numerical concentration limits used in determining if the radwastes are to be released to the receiving water or retreated.

Response:

Prior to the installation of the modified radwaste system, the radionuclide concentration in the condenser cooling water before it enters Lake Michigan shall not exceed 10% of the concentrations specified in 10 CFR Part 20. Following installation and operation of the modified system, the concentration shall not exceed those specified in Item A1 above.

2. Comment:

The statement did not present an adequate description of the thermal discharge system, the predicted results or the effects on the environment.

Response:

A sophisticated mathematical model ~~has~~ was not developed for the existing system to accurately predict the area-depth-temperature frequency relationships as affected by the plant discharge. The general extent of the thermal plume can be inferred by extrapolating measurements made at the J. H. Campbell Plant and the Black River discharges on the eastern shore of Lake Michigan; data which ~~has~~ have been made available to the regulatory agencies, including the Department

of the Interior, in various reports. It has not been shown that aquatic species that could be adversely affected by a thermal plume are present in ecologically significant numbers in the general region of the plant. Therefore, it does not appear that precise predictions of the thermal influence of the plant discharges have any particular relevance.

The heat release from the closed cycle condenser cooling system is discussed in Item A2.

3. Comment:

Alternative methods for cooling the thermal discharge should be given further consideration.

Response:

See Item A2.

4. Comment:

Additional information is needed in chemical releases.

Response:

Present System

Chlorine is added periodically (approximately 2.5 hr/wk) to the condenser cooling water. During the time it is being added, the concentration entering the lake is expected to be about 1 to 2 ppm and will never exceed 6 ppm.

Phosphates and sulfites are added to the steam generator condensate. Assuming a maximum blowdown rate of 50 gpm and dilution in the condenser cooling water, the concentrations entering the lake will not exceed 0.003 ppm and 0.0013 ppm for phosphates and sulfites respectively.

The concentration of boric acid entering the lake shall not exceed 5 ppm.

New Systems (as Discussed in Item A)

Based on the conceptual design of the closed cycle condenser cooling system, it is estimated that the blowdown from the cooling tower will be from 1000 gpm to 8000 gpm and diluted by a flow rate of 50,000 gpm from the lake. The closed cycle water and thus the blowdown water (assuming 8000 gpm) will contain meta-phosphates and zinc. After dilution, the concentration entering the lake is not expected to exceed 1.9 ppm of meta-phoshate and 0.19 ppm of zinc. A more precise concentration of chemicals to be released will be developed after the final design of this system has been completed.

The major change in the chemical concentration released to the lake from steam generator blowdown

is due to the change in the dilution flow from 390,000 gal/min to 50,000 gal/min. Thus the concentrations entering the lake based on 50,000 gal/min dilution will be 0.025 ppm of phosphates and 0.01 ppm of sulfates.

The boric acid release to the lake will be essentially zero.

5. Comment:

Intake structure is not adequately designed to protect fish.

Response:

The description of the cooling water intake should have mentioned that it is of a submerged crib-type design with steel plate covering the top. Therefore, the only direct velocities are in a horizontal direction and vertical velocities are limited to those induced by horizontal flow or by wave or eddy effects.

While the Company has only rarely experienced large numbers of fish at the intake screens of other plants on the Great Lakes, studies have been initiated to evaluate the effectiveness of various types of fish screens that could be installed to divert or repel fish without harming them.

It is believed the closed cycle condenser cooling system will significantly reduce, if not eliminate, the potential for damage.

6. Comment:

Lake water should be analyzed monthly during the first year of operation and Co-60 should be added to the analysis list. Crops should also be analyzed for Sr-90, Cs-137 and I-131 around harvest time each year.

Response:

Lake water will be analyzed for at least the first year of operation of the Palisades Plant for Co-60 on a routine monthly basis if the gross activity of the sample is sufficiently high to merit individual isotopic analysis. The gross level in lake water must exceed 1×10^{-8} uCi/ml before individual nuclides such as Co-60 can be meaningfully identified. Similarly, individual samples of major crops harvested will be analyzed for strontium, cesium and iodine content if gross analysis indicates a level above 5×10^{-8} uCi/ml. These analyses will also be performed for at least the first year of operation of the Palisades Plant.

X

7. Comment:

Should be shown that enough flexibility is provided to meet more stringent water quality standards.

Response:

It is believed that the upgrading of the radioactive waste system and the heat removal system as described in Item A will provide the flexibility referred to in this comment.

8. Comment:

It has not been shown in the "Final Safety Analysis Report" and "Amendments" that the deposition and accumulation of a portion of the cesium-137 expected to be released operationally (assuming 1 percent failed-fuel ratio) or which may be released accidentally may not produce potential problems. Studies which would reasonably predict the potential movement, dispersion and accumulation of the released cesium-137 and which would relate these results to an assessment of the radiation levels presented to the public should be made. In addition, the environmental monitoring program outlined in the "Final Safety Analysis Report" and "Amendments" should include reliable and regular periodic monitoring of lake-bottom sediments.

Response:

The annual dose to the public from eating 40 pounds of fish per year and drinking 2200 cc of water per day containing cesium-137 from the Palisades Plant is calculated to be 3.2×10^{-4} rem and 1.4×10^{-5} rem

respectively. This dose is based on the assumption that the plant operates the entire year with 1% fuel defects, the released concentration is the same as that shown in Table 11-3 of the Final Safety Analysis Report, the concentration in the condensor cooling water is diluted by a factor of 1000 in the lake, and there is a reconcentration of a factor of 1000 in the flesh of fish.

Predictions have also been made of doses from cesium-137 to people swimming in the lake near the Palisades Plant. For the postulated case where the plant operates for forty years with 1% defective fuel and 1% of the cesium released is deposited in the bottom sediment over an area 1 mile long and 0.5 mile wide, the dose would not exceed 4×10^{-7} rem/hr. In addition, the dose from the 99% of cesium-137 dissolved in the water would not exceed 8×10^{-7} rem/hr.

The upgrading of the radioactive waste system will reduce these exposures to essentially zero.

It is inconceivable that an accidental release of radionuclides from the radioactive waste system could occur which would exceed concentrations specified in AEC Standard 10 CFR 20. The system contains radiation monitors on outlet line from the radioactive waste discharge tank, on the service water discharge and on the condenser cooling water before it enters the lake.

These monitors will provide an alarm when the radioactivity in each of the lines and canal indicates that the concentrations entering the lake will exceed one-half of the concentration specified in 10 CFR 20, either on an identified radionuclide or an unknown radionuclide basis (1×10^{-7} uCi/cc).

The radiation monitor on the line from the radioactive waste discharge tank, which is the source of the highest radionuclide concentration, will automatically actuate two isolation valves when a present level is exceeded. The liquid containing the concentration will, therefore, be contained before it enters the condenser cooling water.

The environmental monitoring program developed for Palisades Plant will include reliable and regular periodic monitoring of the lake-bottom sediment as well as the buildup of radionuclides in the aquatic life.

Consumers Power Company, along with five other utilities, whose service areas border Lake Michigan, are participating in a Lake Michigan Radiological Surveillance program whereby concentration factors for some 35 trace elements existing in Lake Michigan, and whose radioactive counterparts could potentially be released in liquid effluent from power reactors, are being measured. The final results of this study showing

concentration factors for aquatic biota and sediment will be available in early 1972. Based upon the results of this study meaningful measurements can be made of movement, dispersion and accumulation of radionuclides within the lake.

C. United States Department of Health, Education and Welfare

1. Comment:

Some method of treating high-solids-content waste, such as by evaporation, should be designed and installed in the Palisades liquid waste treatment system prior to completion of the fuel cycle in order to maintain radioactivity discharges at the lowest practicable levels. The time period specified for gaseous waste holdup should be the maximum possible with the capacity provided in the waste gas holdup system.

Response:

The upgraded liquid radwaste system discussed in Item A will provide capability for extensive processing, by evaporation, the high-solids-content waste as well as the low-solids-content waste. The radioactivity release to the lake will be reduced to as low as practicable. Capability is provided for thirty days holdup of radioactive gases to permit the decay of the xenon isotopes.

2. Comment:

Treated water from the municipal water treatment plant located at South Haven, Michigan, five miles north of Palisades, should be sampled and analyzed as part of the environmental surveillance program.

Response:

The radiological environmental surveillance program includes routine daily and monthly composite water sample analysis of the plant intake and outfall. The outfall sample analysis is particularly appropriate as it is the point of maximum concentration. The intake sample analysis is used for comparative background purposes. Dilution factors shown for Lake Michigan in the Final Safety Analysis Report indicate a factor of greater than 1000 from the plant outfall to the South Haven municipal water treatment plant. Hence, concentrations of radioactive materials above background at this point are not expected. However, for the purpose of assurance that no member of the public using this municipal water supply is being unduly exposed to ionizing radiation of plant origin, a monthly composite sample of treated water from the South Haven municipal water treatment plant will be collected and analyzed for radioactive content.

3. Comment:

Prior to operation of the facility, an off-site radiation emergency plan should be developed and agreed upon between the applicant and the Michigan State Department of Public Health.

Response:

The emergency action plan has been revised to comply with the May 1970 AEC guides. The plan is being reviewed by the Division of Compliance and is being coordinated with the various State and local agency plans.

4. Comment:

A population dose assessment should be presented which is based on calculations of potential total doses from all critical pathways for: 1) Individuals residing in the plant's immediate environs, and 2) The exposed population within 50 miles of the plant expressed as man - rem/yr, taking into consideration environmental and demographic factors.

Response:

The potential radiation exposures to the general public from the Palisades Plant have been calculated and the results, considering the liquid releases to Lake Michigan and the release from the plant in the gaseous form, are as follows:

1.	Annual dose per person eating 40 lb. of fish per year	0.00042 rem/yr
2.	Annual dose per person drinking 2200 cc/day of water	0.000018 rem/yr
3.	Annual dose from radioactive gases at site boundary	0.0059 ~~0.0008~~ rem/yr X
	Total to individual residing at site boundary	0.006 ~~0.0012~~ rem/yr X
4.	Total man-rems/yr within 50 mile radius [redacted] from [redacted] eating fish and drinking water from the Lake near the plant	61.8 X
5.	Total man-rem/yr within 50 mile radius from radioactive gases	49.4
	Total	111.2

The above exposures are based on the assumption that the plant operates a full year with 1% defective fuel and the radionuclide concentrations shown in Table 11-3 and Table 11-4 of the Palisades Final Safety Analysis Report are released to the environment. Thirty-two different radionuclides are considered in predicting the dose from eating fish and drinking water. It is also assumed that the concentration entering the lake is diluted by a factor of 1000. The man-rems/yr dose ~~within a 50 mile radius~~ is based on the assumption that [redacted] 3.8×10^6 lbs. of fish (quantity of edible meat harvested) is consumed annually by people living in the 50 mile radius* and that all the people (1.19×10^6) in this ~~person in this area consumes fish and water from the lake~~ area obtains all their water from the lake near the plant. The dose from the gas is diffused as a function of

* Bureau of Commercial Fisheries Statistical Digest No. 61 U.S. Dept. of Interior, 1968.

distance as represented by the yearly average X/Q and the estimated population for the Year 1980 as shown in Figure II-4 and II-5 of the Final Safety Analysis Report. The wind persistency in any one direction is assumed to be 12.5%.

With the upgraded radwaste processing system discussed in Item A, the release of radionuclides in the liquid will be essentially zero. Subsequently, the dose to the public during normal plant operation will only be from the radioactive gases and, therefore, will not exceed 0.00[illegible]59 rem/yr at the site boundary or a total man-rem/yr within a 50 mile radius of 49.4. X

Since the annual dose from natural background radiation at the site boundary is about 0.125 rem/yr and the total man-rem/yr from natural background radiation within a 50 mile radius is about 148,453, it is concluded that the operation of the Palisades will not significantly increase the radiation exposure to the public and, subsequently, the radiation risk to the public.

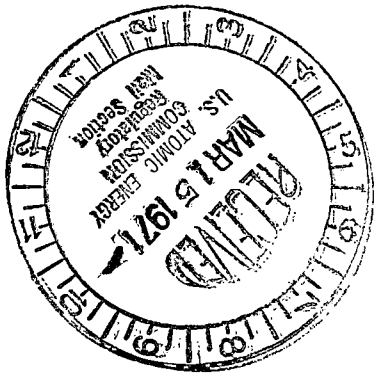
D. Assistant Secretary of Defense

1. Comment:

It was stated that the Palisades Plant circulating water system intake was designed to cause only low horizontal velocities to minimize the potential of fish being drawn through the intake. However, nothing was said about the magnitude of vertical velocities.

Response:

See Item B5.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