

ANSWERS TO QUESTIONS CONCERNING PALIDADES  
\* ENVIRONMENTAL REPORT

Question 1

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.

Answer

*Refer to  
amend. if  
there.*

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.

*RWS*  
Prepared by JZReynolds

QUESTIONS AND ANSWERS (Contd)Question 2

The environmental surveys and monitoring programs were <sup>in</sup>sufficiently described, but other sites similar to the Palisades site have found it necessary to analyze more samples of aquatic species based on standard statistical tests. 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.

Answer

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  $1 \times 10^{-8}$  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  $5 \times 10^{-8}$  uCi/ml. These analyses will also be performed for at least the first year of operation of the Palisades Plant.

*RWS*  
Prepared by JZReynolds-

~~HEB~~  
INTERIOR - HYDROLOGY

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QUESTIONS AND ANSWERS (Contd)

Question 3

In particular, 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 rods) 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.

Answer

If during the operation of the Palisades Plant, Cs-137 or other radionuclides are released in quantities approaching or exceeding those specified in the Final Safety Analysis Report, Section 11 (assuming 1% fuel defects) measurements of lake sediments and lake biota shown to have the capability of significant reconcentration potential will be periodically made. 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.

*Rev S*  
Prepared by JZReynolds

QUESTIONS AND ANSWERS (Contd)

Question 4

The major potential adverse environmental impact associated with the operation of this plant would probably be fish kills at the intake screens. 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. The data provided on the intake system for this plant was insufficient for assessing the environmental impact.

Answer

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.

*Problem goes away in 3 years after cooling installed.*

*JZR*  
Prepared by ~~RWS~~ Sinderman

QUESTIONS AND ANSWERS (Contd)

Question 5

The statement did not present an adequate description of the thermal discharge system, the predicted results, or the effects on the environment. The effect of the thermal plume should be estimated including temperatures, areas and depths. Several aquatic species that use the surface region at some stage of their life cycles could be adversely affected. As indicated by preliminary recommendations from appropriate Federal and State agencies, thermal standards presently <sup>presently</sup> being established for the Lake will probably be considerably less than the 25°F rise intended for the Palisades' facility.

Answer

It is true that no sophisticated mathematical model was developed to attempt 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 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 Company is aware of the preliminary recommendations on thermal standards of the Federal and State agencies and, as the recommendations vacillate, new studies are initiated to determine what modifications would be necessary at the Palisades Plant for compliance.

1212  
Prepared by RWS:inderman

QUESTIONS AND ANSWERS (Contd)

Question 6

Without additional substantiating remarks from the Company, it seems that the intake structure has not been adequately designed for the protection of fish. Fish fry and larvae are damaged unless sufficient provision is made to protect them.

Answer

The Company agrees that "fish fry and larvae are damaged unless sufficient provision is made to protect them." The intake structure incorporates the best design conditions we are aware of to minimize damage to fish life and other aquatic resources, short of special screening devices. The Environmental Report describes the investigation underway to detect the influence of the plant on the aquatic ecology and, (along with Answer 1), the corrections that could be made, should damaging effects become evident.

Problem goes away after cooling tower installation.

Compare before & after.

JZR

Prepared by ~~RWS~~inderman

PUBLIC HEALTH SERVICE

Page 6A

Question No 1

The design and operation of the Palisades Plant radwaste system is presently under review. An evaporator, to handle high-solids-content waste as well as low-solids-content waste, is incorporated in the design as an integral part of the system. It is expected that a revised radwaste system, including the above-mentioned evaporator, will be installed and operable in the Palisades Plant at the completion of the first fuel cycle.

Present "tech specs" commit Consumers Power Company to limit radioactive gas and liquid releases to as low as practicable at the Palisades Plant. Consumers Power Company interprets this to mean that all gases will be held up in the gaseous retention system as long as possible with the capacity provided in the waste gas holdup system.

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  $3.2 \times 10^{-4}$  rem and  $1.4 \times 10^{-5}$  rem

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.

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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 related 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 drinking fish per year and 2200 cc of water per day containing cesium-137 from the Palisades Plant is calculated to be  $3.2 \times 10^{-4}$  rem and  $1.4 \times 10^{-5}$  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.

Response (Contd)

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  $4 \times 10^{-7}$  rem/hr. In addition, the dose from the 99% of cesium-137 dissolved in the water would not exceed  $8 \times 10^{-7}$  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 ( $1 \times 10^{-7}$   $\mu$ Ci/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 preset level is exceeded. The liquid containing the concentration

Response (Contd)

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.

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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 of these calculations, 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<br>eating 40 lb. of fish per year  | 0.00042 rem/yr                     |
| 2. Annual dose per person drinking<br>2200 cc/day of water   | 0.000018 rem/yr                    |
| 3. Annual dose from radioactive gases<br>at site boundary  | <u>0.0008 rem/yr</u>               |
| Total to individual residing<br>at site boundary   | <sup>0.006</sup><br>0.0012 rem/yr  |
| 4. Total man-rem/yr within 50 mile<br>radius, <del>assuming total population</del><br><i>from eating</i> eats fish and drinks <i>water</i> from the<br>Lake near the plant <i>ng</i> | 61.8                               |
| 5. Total man-rem/yr within 50 mile<br>radius from radioactive gases  | <del>49.4</del><br><del>49.4</del> |

Total

~~111.2~~  
111.2

## Response (Contd)

The above exposures are based on the assumption that the plant operates a full year with 1% defective fuel and <sup>the</sup> 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 <sup>are</sup> ~~were~~ considered in predicting the dose from eating fish and drinking water. It <sup>is</sup> ~~was~~ also assumed that the concentration entering the lake <sup>is</sup> ~~was~~ diluted by a factor of 1000. The man-rem/yr dose within a 50 mile radius is based on the assumption that each person in this area consumes fish and water from the lake and the dose from the gas is diffused as a function of 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%.*

Consumers Power Company is now proposing that the liquid radwaste processing system be upgraded to permit evaporation and recycle of the radioactive liquid waste. <sup>similar to the so-called "essentially zero release system"</sup> Subsequently, the dose to the public during normal plant operation will only be from the radioactive gases and, therefore, will not exceed 0.0008 rem/yr at the site boundary or a total man-rem/yr within a 50 mile radius of <sup>49.4</sup> ~~19.9~~.

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.