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Carolina Power & Light Company Raleigh, North Carolina 27602 J. A. Jones	6-7-72	6-12-72	x			
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ENCLOSURES:
APPENDIX "A" - Source Term Calculation Data.

PLANT NAMES:

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Carolina Power & Light Company

Raleigh, North Carolina 27602

June 7, 1972

RECEIVED
JUN 12 1972
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Mr. Edward J. Bloch, Acting Director
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Regulatory File Cy.

RE: DOCKET NO. 50-261

Dear Mr. Bloch:

In connection with your review of the Environmental Report for the H. B. Robinson Steam Electric Plant, Unit No. 2, Mr. D. J. Skovholt forwarded to us in his letter dated May 9, 1972, a list of thirty-three (33) questions related to plant effluents. Enclosed herewith as Appendix A you will find forty-five (45) copies of our responses to these questions. The enclosed information agrees with that in our Final Safety Analysis Report and with information submitted in our Environmental Report. We will be glad to further discuss the Robinson gaseous and liquid effluent design with the staff at the requested meeting on June 12, 1972 at the Robinson Plant.

Yours very truly,

J. A. Jones
Senior Vice President
Engineering & Operating

JAJ:lgb

Enclosure

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In the Matter of)
)
CAROLINA POWER & LIGHT COMPANY) DOCKET NO. 50-261
)
H. B. ROBINSON STEAM ELECTRIC PLANT)
)
UNIT NO. 2)

RECEIVED
JUN 12 1972
U.S. ATOMIC ENERGY COMMISSION
Regulatory Mail Section

AFFIDAVIT OF J. A. JONES

I, J. A. Jones, being duly sworn, depose and state that I am Senior Vice President and Group Executive for Engineering and Operating, Carolina Power & Light Company, and am fully cognizant of the contents of the attached letter and Appendix A to the letter titled, "Basic Data for Source Term Calculation," for the H. B. Robinson Steam Electric Plant, Unit No. 2, and that the contents of the letter and Appendix are true and correct to the best of my knowledge.

J. A. Jones

J. A. Jones

Subscribed and sworn to before me this 7th day of June, 1972, at Raleigh, North Carolina.

Margaret M. Coy

Notary Public

My Commission expires: July 4, 1975

Carolina Power & Light Company

Raleigh, North Carolina 27602

June 7, 1972

RECEIVED
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Engineering & Operating

JAJ:lgb

Enclosure

3201

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H. B. ROBINSON STEAM ELECTRIC PLANT

UNIT NO. 2

APPENDIX A

SOURCE TERM CALCULATION DATA

1. Operating power (MWt) at which impact is to be analyzed.

Response

The operating core power level for impact analyses is 2300 MWt.

2. Weight of U loaded (first loading and equilibrium cycle).

Response

The weight of uranium loaded in the first core is 70.0 MTU; the equilibrium loading is 24.6 MTU.

3. Isotopic ratio in fresh fuel (first loading and equilibrium cycle).

Response

The isotopic ratio for the first core is 2.49 percent U^{235} by weight; the equilibrium isotopic ratio is 3.1 percent U^{235} by weight.

4. Expected percentage of leaking fuel.

Response

Actual radiochemical analysis of the H. B. Robinson Unit No. 2 primary coolant over the commercial operating life of the plant to date has shown no leaking fuel. However, the expected percentage equivalent fuel defects assumed in the Environmental Report was 0.2 percent. This number is based on Westinghouse PWR operating experience with Zircaloy fuel. Accident analyses in the Final Safety Analysis Report (FSAR) assumed the conservative design basis of one (1) percent equivalent fuel defects.

5. Escape rate coefficients used (or reference).

Response

The escape rate coefficients for fission products are as follows:

Element	Escape Rate Coefficients, Sec^{-1}
a. Noble gas isotopes	6.5×10^{-8}
b. Br, I and Cs isotopes	1.3×10^{-8}
c. Te isotopes	1.0×10^{-9}
d. Mo isotopes	2.0×10^{-9}
e. Sr and Ba isotopes	1.0×10^{-11}
f. Y, La, Ce, Pr isotopes	1.6×10^{-12}

6. Plant Factor

Response

A load factor (CP&L) of approximately 70 percent is anticipated until the first scheduled refueling outage. After that time it is anticipated that the load factor will increase to approximately 80 percent. Carolina Power & Light Company defines the load factor as:

$$\frac{\text{energy generated}}{\text{capacity x (hours in year)}}$$

which is equivalent to the EEI capacity factor.

7. Number of steam generators.

Response

There are three steam generators.

8. Type of steam generators (recirculating, straight through).

Response

The steam generators are vertical shell and U-tube evaporators with integral moisture removal equipment. Reactor coolant flows through the inverted U-tubes, entering and leaving through nozzles located in the hemispherical bottom head. The head is divided into inlet and outlet chambers by a vertical partition plate extending from the head to the tube sheet. Steam is generated on the shell side and flows upward through the moisture removal equipment to the steam outlet nozzle at the top of the vessel.

9. Mass of primary coolant in system total (lb) and mass of primary coolant in reactor (lb).

Response

a. The mass of primary coolant in the system total is:

401,500 lbs

b. The mass of primary coolant in the reactor vessel is:

160,600 lbs

10. Primary coolant flow rate (lb/hr).

Response

Reactor coolant flow rate is:

101.5×10^6 lbs/hr

11. Mass of steam and mass of liquid in each steam generator.

Response

The weight of liquid in one steam generator is:

72,600 lbs.

The weight of steam in one steam generator is:

5,000 lbs.

12. Total mass of secondary coolant (lb).

Response

The mass of secondary coolant is:

1.85×10^6 lbs

13. Turbine operating conditions (temperature °F, pressure psi, flow rate lb/hr).

Response

At approximately 2190 MWt, the operating conditions average:

Temperature, °F	522
Turbine pressure, Psia	820
Flow rate, lb/hr	9.47×10^6

14. Total flow rate in the condensate demineralizer (lb/hr).

Response

No condensate demineralizers are provided for the H. B. Robinson Unit No. 2.

15. What is the containment volume (ft^3)?

Response

The containment free volume is:

$$2.1 \times 10^6 ft^3$$

16. What is the expected leak rate of primary coolant to the containment (lb/hr)?

Response

The expected leak rate of primary coolant to the containment is approximately 3 lbs/hr.

17. How often is the containment purged? Is it filtered prior to release? Are iodine absorbers provided? What decontamination factor is expected?

Response

The containment is purged prior to and during maintenance in the containment vessel, which after the first several years of operation is anticipated to be approximately four times per year. The containment vessel is not normally purged during operation. Airborne radioactive particulate and iodine in the containment atmosphere is removed by the containment charcoal auxiliary filter system which has a capacity of 10,000 cfm. Filter efficiencies are 99.9 percent for charcoal filters (halogen removal) and 99.97 percent for HEPA filters (particulate removal).

For purging operations, the Containment Atmosphere Purge Exhaust System consists of two exhaust fans each corresponding to a purge rate of 35,000 cfm. The purge air is processed through roughing and HEPA filters (99.97 percent efficiency) prior to release to the atmosphere. No iodine absorbers are provided on the purge exhaust.

A decontamination factor of 3,333 (99.97 percent efficiency) is expected for particulate removal prior to release.

18. Is there a continuous air cleanup for iodine in the containment? If so, what volume per unit time is circulated through it? What decontamination factor is expected? At what concentration will purging be initiated?

Response

Continuous air cleanup is provided for iodine in the containment by the containment charcoal auxiliary filter system. The system consists of two 5,000 cfm fan-filter units. During power operation, the containment particulate and radiogas monitor indications guide operation of either one or both of these units for pre-access cleanup or prior to purging. Iodine removal efficiency is 99.9 percent based on charcoal absorber DF of 1,000. Filtering efficiency for 0.3μm diameter DOP is 99.97 percent (DF = 3333). Purging operations can be initiated at any time that the iodine concentration is less than 4.35×10^{-10} μCi/cc, and the noble gas concentration is less than 9.1×10^{-6} μCi/cc.

19. Give the total expected continuous letdown rate (lb/hr).

a. What fraction is returned through the demineralizer to the primary system? What is the expected demineralizer efficiency for removal of principal isotopes?

b. What fraction of this goes to the boron control system? How is this treated, demineralization, evaporation, filtration?

c. Is there a separate cation demineralizer to control Li and Cs?

Response

The normal letdown flow rate is 60 gpm (29,826 lb/hr). The maximum is 120 gpm.

a) Approximately 98 percent of the fluid is returned to the primary system under normal steady state conditions.

Minimum expected demineralizer efficiency:
Noble gases, Cs-134, 136, 137, Y-90, 91, and Mo-99, DF=1.
All other isotopes including corrosion products, DF=10.0.

b) Under normal steady state conditions, about 2 percent goes goes to the boron control system. It is treated by demineralization and evaporation.

c) A separate cation bed demineralizer located downstream of the mixed bed demineralizers is available to control Li and Cs.

20. What fraction of the noble gases and iodines are stripped from that portion of the letdown stream which is demineralized to the primary return system? How are these gases collected? What decay do they receive prior to release?

Response

Essentially no noble gas stripping occurs. Demineralizer DF for iodines is 10.0.

21. What fraction of the noble gases and iodines are stripped from that portion of the letdown stream which is sent to the boron control system? How are these gases collected? What decay do they receive prior to release?

Response

The design decontamination factor for the gas stripping unit is approximately 10^5. The gases are collected in waste decay tanks. The gas decay tank's capacity will permit 45 day's decay of waste gas before discharge.

Iodine decontamination is accomplished by demineralizers, followed by evaporators and condensate polishing demineralizers. Iodines remaining in the evaporator concentrate are returned to the system with the highly borated concentrate. An overall DF of about 10^5 is obtained.

22. Are releases from the decay tanks passed through a charcoal absorber? What decontamination factor is expected?

Response

Waste gas from the gas decay tanks may be released under administrative control through the plant vent. No charcoal absorbers are provided.

23. How frequently is the system shut down and degassed? How many volumes of the primary coolant system are degassed in this way each year? What fraction of the gases present are removed? What fraction of other principal nuclides are removed, and by what means? What decay time is provided?

Response

The system is shut down and degassed approximately two times per year. At each of these shutdowns, one reactor coolant volume is degassed. During degassing, essentially 100 percent of the gases present are removed. No credit is taken for removal of other nuclides. Forty-five (45) days decay time is provided.

24. Are there any other methods of degassing (i.e., through pressurizer, etc)? If so describe.

Response

There are no other methods of degassing.

25. If gas is removed through the pressurizer or by other means, how is it treated?

Response

This question does not apply.

26. What is the expected leak rate of primary coolant to the secondary system (lb/hr)?

Response

No primary to secondary leakage is expected; however, the plant has operated with an 8-24 lb/hour primary to secondary leak rate with blowdown controlled as noted in Question 27.

27. What is the normal rate of steam generator blowdown? Where are the gases from the blowdown vent discharged? Are there charcoal absorbers on the blowdown tank vent? If so, what decontamination factor is expected?

Response

Normal blowdown is 10 gal/min. The plant has operated with a 1-3 gal/min blowdown by way of the sample line during the period when an 8-24 lb/hour primary to secondary leak was present. Water from the sample system is treated in the radwaste processing system.

Gases from the blowdown vent are discharged to the atmosphere. No charcoal absorbers are provided in the blowdown vent.

28. What is the expected leak rate of steam to the turbine building? What is the ventilation air flow through the turbine building (CFM)? Where is it discharged? Is the air filtered or treated before discharge? If so, provide expected performance.

Response

The turbine building is an open structure with no ventilation system for the equipment areas. The expected leak rate of steam to the turbine building is approximately 500 lbs/hour.

29. What is the flow rate of gaseous effluent from the main condenser ejector? What treatment is provided? Where is it released?

Response

The flow rate of gaseous effluent from the main condenser mechanical vacuum pumps is 45 cfm. It is released through a local vent. No treatment is provided.

30. What is the origin of the steam used in the gland seals (i.e., is it primary steam, condensate, or demineralized water from a separate source, etc.)? How is the effluent steam from the gland seals treated and disposed of?

Response

The gland sealing steam is non-radioactive and is taken from the main steam system. The effluent steam from the gland seals drains to the gland steam condenser and is returned to the main condenser to be recycled through a closed system. Under normal operation, the exhaust is sent to the atmosphere through the same local vent used to release mechanical vacuum pump effluent.

31. What is the expected leak rate of primary coolant to the auxiliary building? What is the ventilation air flow through the auxiliary building (CFM)? Where is it discharged? Is the air filtered or otherwise treated before discharged? If so, provide expected performance.

Response

The expected leak rate of primary coolant to the auxiliary building is 20 gpd. Ventilation flow through the auxiliary building is approximately 50,000 CFM. The air is discharged to the plant vent through prefilters and HEPA filters of 99.97 percent efficiency. In addition, air exhausted from the residual heat exhanger room, the safety injection pump room, the demineralizer corridor, the pipe corridor and the fuel handling building pipe space may be passed through HEPA filters of 99.97 percent efficiency and charcoal absorbers of 99.9 percent efficiency prior to entering the auxiliary building ventilation exhaust system.

32. Provide average gallons/day and μCi/cc following categories of liquid effluents. Use currently observed data in the industry where different from the SAR or Environmental Report (indicate which is used).

a. High-level wastes (for example, primary coolant letdown, "clean" or low conductivity waste, equipment drains and deaerated wastes);

b. "Dirty" wastes (for example, floor drain wastes, high-conductivity wastes, aerated wastes, and laboratory wastes);

c. Laundry, decontamination, and wash-down wastes;

d. Steam generator blowdown - give average flow rate and maximum short-term flows and their duration;

e. Drains from turbine building.

For these wastes(a-e) provide:

1. Number of capacity of collector tanks.

2. Fraction of water to be recycled or factors controlling decision.

3. Treatment steps - include number, capacity, and process D.F. for each principal nuclide for each step. If step is optional, state factors controlling decision.

4. Cooling time from primary loop to discharge.

5. How is waste concentrate (filter cake, demineralizer resin, evaporator bottoms) handled? Give total volume or weight and curies per day or year.

Response

The following releases are expected during routine operation:

Source of Liquid Waste	Release Rate (gal/day)	Concentration of Source Before Processing (μCi/cc)
Reactor coolant	1,760	3.9×10^{1} (1)
Laundry, showers, handwashes	175	10^{-4}
Laboratories	43	10^{-1}
Decontamination	47	10^{-4}
Turbine building drains (2)	unknown	None
Non-reactor grade leaks	36	10^{-3}
Steam generator blowdown	14,400/S.G.	None

(1) 7.7 percent non-volatile fission and activation products; 92.3 percent fission gases.

(2) The turbine is not enclosed and no radioactively contaminated wastes enter the floor drains of the turbine platform. These drains are piped to the storm sewer.

The number and capacity of tanks are listed below:

Tanks	Quantity	Volume (each unit) gal
CVCS Holdup Tank	3	52,000
Reactor coolant drain tank	1	350
Laundry and hot shower drain tank	2	600
Chemical drain tank	1	375
Waste holdup tank	1	25,000
Monitor tank	2	10,000
Waste condensate tank	2	1,000
Steam generator drain tank	1	1,750

Approximately 5 percent of the water entering the boric acid evaporators is recycled as concentrated boric acid solution. None of the liquid waste listed in the preceding table is recycled.

There are three treatment pathways (1) CVCS holdup tanks to filter to mixed bed demineralizer to gas stripper to boric acid evaporator to anion bed ion exchanger to monitor tank to discharge, (2) waste holdup tank to filter to waste evaporator to mixed bed demineralizer to waste condensate tank to discharge, and (3) chemical drain tank and laundry and hot shower drain tank to waste condensate tank to discharge

The overall decontamination factors are approximately as follows:

Treatment Pathway	H^3 DF	Fission Gas DF	Non-Volatiles DF	Iodine DF
1	1	10^5	10^6	10^5
2	1	N.A.	10^5	10^4
3	1	N.A.	1	1

Spent resins, evaporator bottoms and other solid wastes are sent to the drumming room. Slurries are dewatered and fixed using vermiculite and cement. Dry solid wastes are compacted. All of this waste is packaged in 55-gallon drums or other DOT "specification" containers for off-site shipment and disposal. Three to six 55-gallon drums are expected to be filled per week. The average drum content is not expected to exceed 1 Curie. Drums are held for decay and shielded as required to meet the appropriate regulations for transportation of radioactive materials.

33. Dilution flow rate for liquid effluents, normal gpm and total gallons per year.

Response

a. Normal plant flow rate, gpm 480,216

b. Yearly flow rate, gal/year (based on a 80 percent plant factor) 2.019×10^{11}