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U.S. Nuclear Regulatory Commission
Document Control Desk
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Perry Nuclear Power Plant
Docket No. 50-440
Response to NRC RAI on Accident Dose
Calculation Assumptions (TAC # M83066)

Gentlemen:

By letter dated November 5, 1992, the NRC staff requested additional information to complete an independent analysis of the potential radiological consequences resulting from a design basis accident (LOCA) with leakage through the MSIVs as measured during the Perry Nuclear Power Plant (PNPP) third refuel outage. Attachment 1 to this letter provides answers to the questions provided with your November 5 letter.

If there are any further questions, please feel free to call.

Sincerely,

Robert A. Stratman

RAS:BSF:ss

Attachment

cc: NRC Project Manager
NRC Resident Inspector Office
NRC Region III

130105

Operating Companies
Cleveland Electric Illuminating
Toledo Edison

A001
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RESPONSE TO NRC RAI ON ACCIDENT DOSE CALCULATION ASSUMPTIONS

1. **Provide the mass of liquid associated with the RHR system and the suppression pool following a LOCA.**

   Suppression Pool Volume is 149,935 ft^3 (USAR Table 6.2.5, long term response). This equates to approximately 9.31 E+06 lbm @ 90°F initial conditions.

   RHR piping volume is less than 4800 ft^3. This equates to approximately 2.98 E+05 lbm @ 90°F.

2. **Provide the temperature of the water in the ECCS recirculation loops as a function of time following a LOCA.**

   Refer to USAR Figures 6.2-8 Post LOCA long term response, 6.2-12 short term response.

3. **At what values of leakage for ECCS does the leak reduction program require action by the plant?**

   5 gph. 10 gph is used in the off-site dose analysis (USAR Chapter 15.6.5.5.1.2.b).

4. **Confirm that the ECCS begins operation 30 minutes after the LOCA.**

   ECCS starts immediately after LOCA upon detection of Low RPV level or High drywell pressure (USAR Chapter 6.3 and Tables 6.3-1&2).

5. **Confirm that the airborne portion of ECCS leakage is not filtered by an ESF filtration unit.**

   Confirmed (USAR Chapter 15.6.5.5.1.2.b).

6. **Following the LOCA, if a hydrogen purge is required, when does it end, what is the criteria for ending it, and how long does the purge last?**

   Hydrogen purge is not used to control Hydrogen at Perry. It is used for long term Post-LOCA clean-up activity where the expected dose is less than plant Tech Spec allowable. See USAR Chapter 6.2.5, Revision 5.

7. **What is the interaction rate (ft^3/hr) between the unsprayed containment region and the suppression pool region?**

   Refer to USAR sections 6.5.2 and 15.6.5.5.1.1 and Tables 6.5-9, 10 & 11.

8. **Provide the inside pipe diameter, the pipe length, pipe thickness, pipe mass per unit length (pound/ft or kg/m), insulation thickness, temperature at the time the LOCA begins and the flow velocity for the following items: main steam line, drain line, drain line header.**

	MS Line	MS Drains to Condenser		
	RPV to Steam Chest	In-Board	Out-Board	MS Stop Valve
Inner Diameter	28 in	3 in	2 in	2 in
Pipe length	268 ft	274 ft	224 ft	208 ft
Pipe thickness	2.406 in	.438 in	.344 in	.344 in
Pipe mass/length	657.68lb/ft	14.32lb/ft	7.46lb/ft	7.46lb/ft
Insulation thickness	3.5 in	2.5 in	2.5 in	2.5 in
Temp	545°F	545°F	545°F	545°F
Flow velocity	$4X10^6$ lbm/hr	77.5 lbm/hr	55 lbm/hr*	30 lbm/hr*

*These two lines isolate at greater than 50% steam flow.

Also all three drain lines connect to a 24 inch header at the condenser.

9. **Provide the volume of the condenser above the inlet port and the volume of air changes per hour.**

Volume of the condenser is 130,000 ft^3 (Refer to PY-CEI/NRR-0712L).

Volume of air changes in an isolated condenser would be expected to be very low considering that the condenser would be at atmospheric pressure.

10. **Provide a copy of Topical Report GAI-TR-101-NP-A.**

This report is available for review onsite and a copy has been provided to the NRC Resident Inspector.

11. **Supplement 10 of the Perry SER states that unfiltered inleakage to the control room is limited to 90 cfm as verified by testing. Is such testing performed on a routine basis? If so, how often and what have the results been?**

Perry's Control Room HVAC is described in USAR Chapters 6.4.2.2.2 and 6.4.2.3. Based on its' design, during emergency operation it is kept at neutral pressure with respect to outside. Leak testing of the outside air intake and exhaust dampers is performed per Tech Spec Surveillances 4.7.2.e.4 and 5, at least once per 18 months. Performance of these surveillances during RFO-3 resulted in the following leak rate test results:

	As-Found Test Result	Post-Rework Test Result
M25-F010A and 20B	33 SCFM	0 SCFM
M25-F130A	11 SCFM	No rework (11)
M25-F010B and 20A	14 SCFM	0 SCFM
M25-F130B	8 SCFM	No rework (8)
Total Leakage Values	66 SCFM	19 SCFM

As described in USAR Section 6.4.2.3, infiltration through other pathways is minimal. This was verified by preoperational testing. As a good practice measure, we perform a confirmatory test every Refuel Outage to insure that the boundary is maintained consistent with the results of a similar test performed during the plants preoperational test phase.

12. **For a LOCA, is the containment high pressure setpoint always exceeded? If not, when are the sprays manually actuated?**

For design basis analyses, Containment (wetwell) pressure as a function of time is shown on USAR Figures 6.2-2, 6.2-11 and 6.2-16 for a variety of Loss-of-Coolant Accidents. For each of these design basis analyses, the Containment high pressure setpoint is exceeded.

In a more realistic case, where credit is taken for the containment heat sinks, containment pressure does not reach the spray initiation set point. The design basis Control Room dose analysis did not take credit for automatic initiation of containment sprays, it is simply assumed that the Control Room operator manually actuated containment sprays 10 minutes after a LOCA.

The plant procedure for "Control Room Habitability" directs that if the Control Room Area Radiation Monitor alarm setpoint is exceeded and reactor vessel water level has been below top of active fuel (TAF), that one loop of Containment Spray be initiated (provided other symptom-based plant emergency instructions do not preclude redirection of water flow away from injection to the core). The plant emergency instruction addessing Containment Pressure Control also directs use of containment sprays for certain conditions, but these are unrelated to dose considerations.

When a realistic source term is assumed, the Containment Sprays are not required for dose control.

13. **There seems to be conflicting information in the Perry UFSAR. In one section of the UFSAR, it is stated that the sprays are actuated 10 minutes after a LOCA (pg. 6.5-11). In another section of the UFSAR, it is stated that the sprays are actuated 180 seconds after the containment pressure equals 9 psig or LOCA plus 13 minutes, whichever is later (pg 6.2-40). Which of the two statements is correct for the LOCA analysis?**

Design of the containment spray system for auto initiation post LOCA is 10 minutes after LOCA with High Containment pressure permissive (USAR pg. 6.5-11). The assumption stated on pg. 6.2-40 is for a conservative analysis to maximize the affects of steam by-pass of the suppression pool and is unrelated to the containment spray initiation design basis.

14. **Provide the CHI/Q values for releases from the turbine building to the control room intake, the LPZ and the EAB.**

X/Q's for a release from Turbine Bldg.:

Time Period	Control Room X/Q
0 - 8 hrs	1.9×10^{-3} sec/m^3
8 - 24 hrs	1.2×10^{-3} sec/m^3
1 - 4 days	7×10^{-4} sec/m^3
4 - 30 days	2.8×10^{-4} sec/m^3

Time	EAB/LPZ X/Q
0 - 2 hrs (EAB)	4.3×10^{-4} sec/m^3
0 - 8 hrs (LPZ)	4.8×10^{-5} sec/m^3
8 - 24 hrs (LPZ)	3.3×10^{-5} sec/m^3
1 - 4 days (LPZ)	1.4×10^{-5} sec/m^3
4 - 30 days (LPZ)	4.1×10^{-6} sec/m^3

15. **Provide your accident analysis associated with LER-92-006-01 which demonstrates that Part 100 doses and GDC 19 doses were not exceeded.**

This analysis is available for review onsite and a copy has been provided to the NRC Resident Inspector.

16. **Provide the wetted surface area of the walls covered by the containment sprays.**

The only spray volume considered inside containment is from refueling deck elev. 689'-6" to the lowest spray ring elev. 735'-3" which translates conservatively to 16,000 ft^2 containment wall surface area.

17. **Provide the terminal velocity of the mass-mean drop for the containment sprays.**

Refer to USAR Table 6.5-10.

18. **The sources of releases for the LOCA analysis include the containment leakage which bypasses the AEGTS and which is released directly to the environment, MSIV leakage which is released from the turbine building, leakage from ECCS operations including RHR operation, and containment purge. For each of these release points provide the distance to the EAB, LPZ and the location of the control room ventilation equipment and the control room doors; the Chi/Q values for the above locations for the**

0-2 hour, 0-8 hour, 8-24 hour, 1-4 day and 4-30 day time periods; the 5% wind speed, and the dimensions of the buildings from which the containment leakage, MSIV leakage and the ECCS leakage are released.

Refer to USAR Table 2.3-24 for design basis and realistic X/Q's for EAB and LPZ. For design basis Control Room X/Q, refer to USAR Table 15.6-12. Realistic Control Room X/Q's are:

Time	X/Q
0 - 8 hrs	7.0×10^{-5} sec/m^3
8 - 24 hrs	5.6×10^{-5} sec/m^3
1 - 4 days	4.3×10^{-5} sec/m^3
4 - 30 days	1.5×10^{-5} sec/m^3

Control Room air intake is on east wall of the control complex at approximately elevation 585' (Refer USAR Figures 1.2-9 and 1.2-13).

Distances requested are shown on USAR Figures 2.1-18, 2.1-5, 2.1-4.

Building dimensions and locations of the plant vents are shown on USAR Figure 1.2-10.

19. **At what MSIV leakage rate is the MSIVLCS isolated?**

The design of the MSIV-LCS is such that only the inboard system has an isolation, which is set at 20 SCFH/line. However, all four lines need to be isolated for the common blower to isolate. The outboard system will continue to operate to route leakage to the Annulus Exhaust Gas Treatment System for processing. See USAR Section 6.7.

Additional Information: Standard Review Plan Section 6.5.5 "Pressure Suppression Pool as a Fission Product Cleanup System" had not been issued at the time of PNPP Unit 1 Licensing. A Pool Decontamination Factor of at least 10 could be utilized for the ratio of particulate and elemental iodine contaminants entering the pool to the amount leaving. This would result in a substantial reduction in design basis doses, which has not been previously credited at PNPP.