GPU Nuclear

GPU Nuclear Corporation
One Upper Pond Road
Parsippany, New Jersey 07054
201-316-7000
TELEX 136-482
Writer's Direct Dial Number:

Docket No 50-219

August 12, 1988

Alexander W. Dromerick
U.S. Nuclear Regulatory Commission
1 White Flint North
11555 Rockville Pike
Rockville, MD 20852

Dear Mr. Dromerick:

During our conference call on May 26, 1988 you requested additional information concerning SEP Topic III-4A (IPSAR Section 4.6.4), Tornado Missile (see attached telphone communication note).

Our responses to all five questions received are provided in the enclosure. We believe that the information being submitted is sufficient to resolve the issues relating to the IPSAR Section 4.6.4.

Very truly yours,

Yosh Nagai

Yosh Nagai
Senior Licensing Engineer

/jbw

Attachment

cc: M.W. Laggart w/o enclosure
T. Dempsey
N. Shah
Angela T. Chu - NRC (NRR)

PDR
LPDR
~~Docket File~~

8808260105 880812
PDR ADOCK 05000219
P PNU

OF01
1/1

GPU Nuclear Corporation is a subsidiary of General Public Utilities Corporation

☐ Telephone Call-in
☒ Telephone Call-out
☐ Interview

GPU Nuclear

Communication Notes

Date/Time: May 26, 1988

Project:

Person Contacted: A. Dromerick, A. Chu, J. Kudrick

Location:

Phone: 301-492-1301 Ext

Company: NRR/NRc - Rockville, Md.

T. Dempsey, N. Shah and Y. Nagai talked to the NRC Staff listed above. The purpose of the telephone conversation was to discuss SEP Topic III-4A, Tornado Missiles. GPUN letter described the methodology, following tornado missiles, to maintain the the plant in a hot shutdown condition by utilizing the existing piping which takes suction from the torus and supplies the isolation condenser. During the telephone conversation, the staff requested GPUN provide the following information:

1. Discuss how long the torus water would be available.
2. Accessibility of the locally operated manual valves (4 valves)
3. Explain why NPSH is not an issue for the core spray pump.
4. How soon can GPUN issue appropriate (diagnostic & restoration) procedures or revise the procedures?
5. Explain how a diagnostic & restoration procedure is invoked.

Currently, T. Dempsey and N. Shah are putting together our responses to the above questions. The staff requested written responses as soon as possible. T. Dempsey and N. Shah will provide the information to M. Laggart.

Signature: M. Laggart for Y. NAGAI

cc: T. Dempsey M. Laggart
N. Shah

A0000945

GPU Nuclear Calculation Sheet

Subject	Calc No	Rev No	Sheet No
Isolation Condenser Makeup During Tornado Event	C-1302-211-5450-040	0	1 of 4

Originator	Date	Reviewed by	Date
P. S. Smith	2 August 1988		

1. Torus Water Availability

I. STATEMENT OF PROBLEM

During a tornado event at Oyster Creek, decay heat from the reactor will be removed by the Isolation Condensers (IC). Makeup for the boiloff from the IC will be provided from the torus via a connection on one of the core spray main pumps. This calculation computes the amount of time after reactor shutdown for which the decay heat can be removed by adding 10,000 ft^3 of makeup water to the IC shell from the torus.

II. SUMMARY OF RESULTS

By adding 10,000 ft^3 of water from the torus to the shellside of the IC, this system is capable of removing decay heat from the reactor core for approximately 11.5 hours excluding the amount of water initially in the IC shells. If the initial shellside inventory is considered, the ICs are capable of removing decay heat for about 13 hours.

III. REFERENCES

1. Oyster Creek Operations Plant Manual, module 23, 'Isolation Condensers', Revision 0, March 1987.
2. 'RETRAN-02 - A Program for Transient Thermal-Hydraulic Analysis of Complex Fluid Flow Systems', EPRI report NP-1850-CCMa, Volume 1, Revision 2, Section V, November 1984.
3. ASME Steam Tables, Fourth Edition, 1979.

IV. ASSUMPTIONS & BASIC DATA

1. Enthalpy of steam at 5 psig (IC shellside operating pressure) $h_g = 1156$ BTU/lbm (Ref 3)
2. Enthalpy of torus water at 0 psig, 90°F $h_o = 58$ BTU/lbm (Ref 3)
3. Density of torus water at 0 psig, 90°F $\rho = 62.1$ lbm/ft^3 (Ref 3)
4. Decay heat data based on Reference 2.

V. CALCULATIONS

In order to determine the time after reactor shutdown for which core decay heat can be removed by adding 10,000 ft^3 of shell side makeup water from the torus, the following procedure was followed:

V. CALCULATIONS (continued)

1. Assume a time after shutdown (t).
2. Calculate integrated decay heat using the program in Appendix A (Q(t)).
3. Compute the mass of water required to remove that amount of energy (m)

$$m = \frac{Q(t)}{hg - ho}$$

4. Compute the volume of water equivalent to that mass of water (V)

$$V = \frac{m}{\rho}$$

5. Repeat steps 1-4 until volume < 10,000 ft³.

The solution was obtained in 3 iterations.

Iteration 1

1. assume t = 8 hrs
2. Q = 5.3E8 BTU
3. $m = \frac{5.3E8\ BTU}{(1156-58)\ BTU/lbm} = 482,696\ lbm$
4. $V = \frac{482,696\ lbm}{62.1\ lbm/ft^3} = 7,773\ ft^3$

Iteration 2

1. assume t = 12 hrs
2. Q = 7.057E8 BTU
3. $m = \frac{7.057E8\ BTU}{(1156-58)\ BTU/lbm} = 642,714\ lbm$
4. $V = \frac{642,714\ lbm}{62.1\ lbm/ft^3} = 10,350\ ft^3$

V CALCULATIONS (continued)

Iteration 3

1. Assume $t = 11.5$ hrs
2. $Q = 6.855E8$ BTU
3. $m = \dfrac{6.855E8 \text{ BTU}}{(1156-58) \text{ BTU/lbm}} = 624{,}317$ lbm

4. $V = \dfrac{624{,}317 \text{ lbm}}{62.1 \text{ lbm/ft}^3} = 10{,}053 \text{ ft}^3$ this is close to $10{,}000 \text{ ft}^3$.

During normal operations, the IC shells have a water inventory capable of removing decay heat for 1.5 hours (reference 1). So if the initial water inventory is considered, the IC system is capable of removing decay heat for approximately 13 hours assuming there is $10{,}000 \text{ ft}^3$ water inventory added to the shell.

APPENDIX A

Program for computing integrated decay heat

```
PROGRAM DECAYHR
SIGNIFICANCE 4
TIME=ARRAY(0,0.1,1,2,4,6,8,10,20,40,60,8[illegible]
TIME=ARRAY(TIME,2E3,4E3,6E3,8E3,1E4,2E4,4E4,6E4,8E4,1E5,2E5,4E5)
TIME=ARRAY(TIME,6E5,8E5,1E6,2E6,4E6,6E6,8E6,1E7,2E7,4E7,6E7,8E7)
TIME=ARRAY(TIME,1E8,2E8,4E8,6E8,8E8,1E9)
DECAY1=ARRAY([illegible],590,450,396,365,346,331,[illegible]
DECAY1=ARRAY(DECAY1,235,211,196,185,157,128,112,105,96,[illegible],79.5)
DECAY1=ARRAY(DECAY1,62.5,56.3,50.5,47.5,40,33.9,31,28.2,26.2)
DECAY1=ARRAY(DECAY1,21.5,16.6,14.3,13,11.7,8.9,6.8,6.2,5.7,5.5)
DECAY1=ARRAY(DECAY1,4.85,4.15,3.6,3.93,2.67)
DECAY1=DECAY1/1E4
ASK('INPUT STEADY STATE POWER (MW)','P0=')
INPUT:ASK('INPUT TIME(HR)','TIME1=')
T=3600*TIME1
FRACT=INTERPOL(T,DECAY1,TIME)
POWER=FRACT*P0
BTUPOWER=3.413E6*POWER
FOR I=1,48
IF(T.LE.TIME(I)) GOTO INT
TIME2(I)=TIME(I)
DECAY2(I)=DECAY1(I)
NEXT I
PRINT('******** ERROR -TIME TOO LARGE *********')
***
STOP
INT:TIME2(I)=T
DECAY2(I)=FRACT
INTFRACT=INTEG(DECAY2,TIME2)
INTPOWER=INTFRACT*P0/3600
BTUINT=3.413E6*INTPOWER
PRINT('TIME = ',MELDNAME(TIME1),' HR')
PRINT ('INSTANTANEOUS DECAY HEAT FRACTION = ',MELDNAME(FRACT))
PRINT ('INSTANTANEOUS DECAY HEAT = ',MELDNAME(POWER),' MW')
PRINT ('                                   ',MELDNAME(BTUPOWER),' BTU/HR')
PRINT ('INTEGRATED DECAY HEAT FRACTION = ',MELDNAME(INTFRACT(I)))
PRINT ('INTEGRATED DECAY HEAT = ',MELDNAME(INTPOWER(I)),' MW-HR')
PRINT ('                                 ',MELDNAME(BTUINT(I)),' BTU')
ASK ('INPUT OPTION (0=EXIT 1=MORE INPUT)','OPT=')
IF(OPT.EQ.1) GOTO INPUT
END
```

2. Physical Location Of Valves For Operational Accessibility:

V-11-110, 111	Reactor Building, elevation 56"-9". The valves are located at 5'-9" above Reactor Building floor (Elevation 51'). No ladder required.
V-11-4	Ladder required for operation, but alternately V-11-15 can be closed.
V-11-15	Reactor Building, elevation 23'. The valve is close to the floor, no ladder required for operation.
V-11-34, 36	Air operated valves, operable from control room. Also, manual handwheel available for operation. Valves are on Reactor Building 95' elevation, one foot off the floor.

3. Core Spray Pump NPSH:

Available NPSH using downcomer elevation is greater than pump NPSH requirement (NPSH avail $\simeq$ 39' > 12' NPSH req'd at 2600 gpm)

4. Schedule For Procedure Implementation:

Procedure to be revised is 2000-OPS-3024.18, Iso-condenser-Diagnostic and Restoration Actions. This procedure will cover the alternate fill path from the torus using core spray system.

The schedule for procedure revision is October 30, 1988.

5. Use Of Procedure:

For a tornado event, operator will use normal condensate transfer system first, which is the normal fill path. If he finds that this path is not available, he will enter the Diagnostic and Restoration procedure (see item 4 above) and use alternate fill path using torus.