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NRR

4/5/79

EFFORTS RELATED TO EQUIPMENT SURVIVABILITY

I FEEDBACK ON RADIATION WITHSTAND CAPABILITY OF FOXBORO AND BAILEY TRANSMITTERS

Naval Reactors — No experience with either Bailey or Foxboro transmitters (of Designs used in commercial plant).

Sandia — No experience in weapons area. However, Sandia contacted Bailey and Foxboro. No additional information on Bailey's, but certain Foxboro pressure transmitters are equipped with hardened amplifiers (RC 22-PT1 through 8 which are used to measure reactor coolant pump seal cavity pressure). They have survived tests involving exposure to 2×10^8 R/hr. Therefore, should existing reactor coolant pump pressure transmitters fail, these hardened transmitters should be available as backup to measure reactor coolant pressure.

II ESTIMATES OF FAILURE TIMES FOR PRESSURE TRANSMITTERS AND OTHER VITAL EQUIPMENT DUE TO RADIATION

Approach: Knowing radiation withstand capability of equipment (based on test), calculate dose rate due to containment atmosphere and water at bottom of containment, and estimate equipment and lifetime.

Basis for Dose Rate Calculation:

(a) Assume containment air sample represents containment atmosphere.

(b) Assume water in containment has same constituents as coolant sample taken on 3-31-79.

Results: ORNL has calculated dose at location of pressure transmitters to be 1×10^4 R/hr.

Bailey transmitter BY is qualified to 1×10^5 R Using dose of 1×10^4 R/hr, one would expect this instrument to survive only about 10 hours. Since several of the Bailey transmitters continue to function, we are assuming that the dose calculation is grossly in error. Without a better estimate of the source terms, particularly a good estimate

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of the activity of the water in the containment sump, it is impossible to estimate failure times of vital equipment.

III ASSESSMENT OF CRITICAL EQUIPMENT

- Have established design radiation level and location inside containment of all Foxboro, Bailey pressure and differential pressure transmitters and Rosemount Temperature sensors (see Enclosure 1).

- Have established location of all critical components of decay heat removal system (have not established design radiation levels).

- We are looking at reactor coolant pumps (Allis-Chalmers). We will provide additional information later.

- Fan cooler motors - we have established that they were tested to 10^9 Rads.

- Containment isolation valves - we don't believe external radiation is a problem. Radiation inside of valve is estimated to be 2000 R/hr. Assuming seat can take $\sim 10^6$ to 10^7, seat will last 22 days. However, radiation level should drop with time. Therefore, valve seat may last substantially longer.

- Effect of dumping 250 gpm of coolant on containment floor has been calculated (see Enclosure 2 and Enclosure 3) - times when various pieces of equipment would be flooded are enclosed.

B+W Instruments Inside Containment (Backbone) 4-3-79

IA - Inst Mounted By Itself
IR - Inst Mounted In Rack

For Present Operating Mode

Parameter	Inst Ident #	Mounting	Type	Rad Level Design	Rad Level at Equip	Above 232'6" Level
S.G. B Press	SP6B-PT1	IMA 13	Fox E11GH	10^4		2'5"
RC Flow Lp A	RC 14A-DPT-3+4	IMA 14+15	Bailey BY	10^5-10^7		3'0"
Pressurizer Level	RC-1-LT 1,2+3	IR-424+425	Bailey BY	10^5-10^7		3'6"
SG "B" Press	SP6B-PT2	IR-428	Fox E11GH	10^7		
RC Flow Lp A	RC14A-DPT1+2	IR 425+426	Bailey BY	10^5-10^7		
RC Flow Lp B	RC14B-DPT3+4	IR-429+430	Bailey BY	10^5-10^7		
RC Flow Lp B	RC14B-DPT1+2	IM-12+13	Bailey BY	10^5-10^7		
SG "A" Level	SP1A-LT 2+3	IR-426	Bailey BY	10^5-10^7		
SG "A" Level (S.U.)	SP1A LT 4+5	IR-426	Bailey BY	10^5-10^7		
SG "B" Level	SP1B LT 1,2+3	IR-428	Bailey BY	10^5-10^7		
SG "B" Level (S.U.)	SP1B LT 4+5	IR-428	Bailey BY	10^5-10^7		
SG A Level	SP1A LT1	IR 426	Bailey BY	10^5-10^7		5'2"
SG "A" Press	SP6A PT1+2	IR 426+424	Fox E11GH	10^7		
RC Press (W.R.)	RC3A PT3+4	IR 425+427	Fox E11GH	10^7		
RC Press (N.R.)	RC3A PT5	IR 424	Fox E11GH	10^7		
RC Press (W.R.)	RC3B PT3	IR 429	Fox E11GH	10^7		
RC Temp A Loop (N.R. T_c)	RC5A TE 2+4		Rosemount	10^8		
RC Temp B Loop (N.R. T_c)	RC5B TE 2+4		Rosemount	10^8		
RC Temp A Loop (W.R. T_h)	RC15A TE 1					
RC Temp A Loop (W.R. T_c)	RC15A TE 2+3					
RC Temp B Loop (W.R. T_h)	RC15B TE 1					
RC Temp B Loop (W.R. T_c)	RC15B TE 2+3					
Pr Temp	RC 2 TE 1+2					

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Enclosure 2

FLOOD TIMES

@ 250 GPM = 15000 GPH
12" = 74,330 gal
1" = 6194.2
15,000 G/HR = 2.42"/HR.

Starting Point = 2 feet

2 hrs 10 min — Steam Gen Press Loop B (1 of 2)
4 hrs 50 min — Reactor Coolant flow Loop A (2 of 4)
7 hrs 30 min — Press Level (3 of 3)
Steam Generator Press Loop B (2 of 2)
Reactor Cool Flow Loop A (2 of 4)
React Cool Flow Loop B (2 of 4)

(Loop A) (5 Total)
- Steam Gen Lev (Operate Range) (2 of 5)
- Steam Gen Lev (Start-up Range) (4 of 5)

(Loop B) (5 Total)
- Stm Gen Lev Full Range (1 of 5)
- Stm Gen Lev (Operate) (3 of 5)
- Stm Gen Level (Startup Range) (5 of 5)

15 hrs 45 min — Stm Gen Level A (full Range) (5 of 5) ==
Stm Gen Press Loop A (2 of 2)
React Cool Press Loop A (2 of 2)
Wide Range
React Cool Press Loop A (1 of 1)
Low Range
React Cool Press Wide (1 of 1)
Loop B

Penetrations (Start) 39 hrs, 40 min

D.H Valves for shutdown cooling 49 hrs, 40 min

Reactor Coolant PUmps 8 day, 16 hrs, 50 min.

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Enclosure 3

TRANSMITTER SUBMERGED STATUS

Elevation above ground level

2'-5" ----------Steam Gen. Press. Loop B (1of2)

3'-0" ----------Reactor Coolant Flow Loop A (2of4)

3'-4" ----------Flood Level (Based on transmitted site calculations of 4/5/79)

3'-6" ----------Press. Level (3of3)
Stm. Gen. Press Loop B (2of2)
React Cool. Flow LoopA (2of4)
React. Cool. Flow Loop B (2of4)
Stm. Gen Lev. Loop A (operate range)(2of5)
" " "" " (start-up range)(4of5)
" "" " " B (Full range) (1of5)
" " " " B (operate range) (3of5)
" " " " B (start up range) (5of5)
React. Cool. Pump Seal Cavity Press. (8of8)

5'-2" ----------Stm. Gen. Lev. Loop A (Full range) (5of5)
Stm. Gen. Press. Loop A (2of2)
React. Cool. Press. Loop A (2of2)Wide range.
" " " " A (1of1)Low range.
" " " Loop B (1of1) wide range.

10'-6" ----------Bottom of the lowest Electrical Penetration

12'-0" ----------Bottom of the motor housing of the D.H.Valves for shutdown cooling.

46'-0'----------Bottom of the motor housing of the Reactor Cooling Pumps.

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A. Q. What is the status of environmental qualification considerations of the TMI-2 facility?

B. Much of the equipment currently being relied upon in the present (418) mode of operation, (forced circulation of the RCS and heat rejection to the main condenser through a steam generator), are not safety grade equipment and therefore not covered by NRC requirements. All instruments important to the present mode of operation, i.e., RCS parameters, are located in the annulus between the shielding wall and the containment wall. These instruments, based on available information, will function with doses up to 10^7 Rad. Estimated dose rate is 10^4 rad/hrs. Therefore, this dose will be reached in approximately 40 days. Other equipment in the containment is generally estimated to be able to function with doses between 10^5 to 10^8 Rad. The dose rate in the containment is estimated to range from 800 to 2000 Rad/hr. A critical component is the surge capacitor on the reactor coolant pump motor, that is variously estimated to have a life of 18 to 125 days.

Water level in the containment is estimated to be over there above the floor. Therefore a steam generator level and RC flow instrument may be submerged. Nine other instruments, including pressurizer level, are mounted 6 to 12 inches higher and could be near the water level.

Additional details are provided in the attached memorandum.