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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289 SP
	)	(Restart)
(Three Mile Island Nuclear	)	
Station, Unit No. 1)	)	

LICENSEE'S RESPONSE

TO

BOARD QUESTIONS

CONCERNING 10,000 GALLON SPILL

AT TMI-1 IN JUNE, 1980

BOARD QUESTIONS (Tr. 2064-69, August 12, 1980):

- How did the accident occur?
- What operator error was involved?
- Why were 10,000 gallons allowed to leak before it was stopped?
- What maintenance was underway at the time and why?
- What steps have been taken to avoid a recurrence?
- Is there a particular problem with this unit? - Is this a recurring problem or does it involve a particular maintenance problem for Unit 1?
- Provide a narrative of two years of operation, to include one year of actual operation, of maintenance on the makeup and purification systems and the once-through steam generators.
- What was the relationship of water involved in the leak on the separation of storage facilities in Units 1 and 2?

RESPONSE:

Plant Conditions at the Time of the June 27, 1980 Spill:

Three Mile Island Unit 1 was shut down as it had been since February 1979. Decay heat generation was less than 0.5 megawatts thermal and the decay heat was being removed by the "A" Decay Heat Removal System. The Reactor Coolant System (RCS) level was being maintained at an abnormally low level (315'-2" Elevation) of about 14 inches above the centerline of the cold legs to permit installation of the High Pressure Injection (HPI) restart modification, inspection of Makeup and

Purification System check valves and eddy current testing of the "B" Once Through Steam Generators (OTSG). The procedure being used to maintain RCS water level, which includes a figure depicting relative water levels in the OTSG and makeup and purification system, is attached. The Engineered Safeguards Actuation System (ESAS) was in bypass, which is normal for cold shutdown conditions. The "B" OTSG upper and lower manways and lower plenum handhole were open, and final preparations were being made to plug one of the tubes in the "B" OTSG. The tube plugging operation was scheduled for late in the morning, June 27, 1980. No other major plant evolution was in progress except for a routine transfer of the "A" Vital Bus from its normal power supply, the "A" Inverter, to an alternate power supply, the "E" Inverter, in order to conduct minor maintenance of the "A" inverter. The work requests associated with all the above work are attached.

Sequence of Events: (Using Computer Alarm Printer as basis)

09:01:51 "A" Inverter and "A" Vital Bus are de-energized.

Comments: When a vital bus is de-energized, both ESAS channels being fed from the vital bus assume a "tripped" state. In this case, Channels 1A and 1B assumed a "tripped" state leaving the ESAS in a one-out-of-two logic for actuation on either Actuation "A" or "B" if another channel is removed

from the bypassed state or a trip is proved reflecting degraded plant conditions.

09:01:56 "A" Vital Bus re-energized as noted by "normal" power indication returning to the "A" Reactor Protection System (RPS) cabinet.

Comments: ESAS Channels 1A and 1B remain in the "tripped" state by design unless the trip setpoint has not been reached. Deliberate operator action is required to re-establish the bypassed state by physically pushing the bypass pushbuttons. In this case, the operator was required to push bypass pushbuttons RC-1A (HPI) and RC-4A (LPI) for Channel 1A and RC-1B (HPI) and RC-4B (LPI) for Channel 1B. The Reactor Building Isolation Channels (RB-1A and RB-1B) automatically returned to the bypassed state because the trip setpoint had not been reached.

09:02:12 Channel 2A, specifically RC-2A (HPI), is reset (i.e., is removed from the bypass condition).

Comments: At this point, ESAS Actuation "A" (HPI) occurs because one-out-of-two remaining HPI channels (RC-2A and RC-3A) is removed from bypass and actual Reactor Coolant System (RCS) pressure is below the 1600 psig setpoint required to trip the channel. The logic is in a two-out-of-three actuation state.

09:02:13 Channel 3A, specifically RC-3A (HPI) is reset (i.e., is removed from the bypass condition).

Comments: This does not result in any additional actuation in that a two-out-of-three logic and three-out-of-three logic result is the same actuation.

09:02:14 DH-V5A begins to open.

Comments: Valve stroke time is approximately ten seconds. As DH-V5A opens, the BWST begins to drain by gravity, filling the RCS through the decay heat removal drop line. The RCS fills up to the Reactor Coolant Pumps, spills over into the "C" and "D" cold legs, out the "B" OTSG lower plenum handhole and manhole openings and onto the Containment Building floor.

09:02:30 Channel 1A (RC-1A HPI) is bypassed.

Comments: The operator depressed the RC-1A HPI bypass pushbutton.

09:02:31 Channels 2A and 3A (RC-2A HPI and RC-3A HPI) are bypassed.

Comments: The operator depressed the RC-2A HPI and RC-3A HPI bypass pushbuttons. At this point, the ESAS Actuation is bypassed.

09:02:39 Channel 1A (RC-4A LPI) is bypassed.

Comments: The operator depressed the RC-4A LPI bypass pushbutton.

09:02:42 Channel 1B (RC-1B HPI) is bypassed.

Comments: The operator depressed the RC-1B HPI bypass pushbutton.

09:02:43 Channel 1B (RC-4B LPI) is bypassed.

Comments: The operator depressed the RC-4B LPI bypass pushbutton.

09:04:23 DH-V5A is closed.

Comments: DH-V5A was open for only 2 minutes and 9 seconds, including the valve stroke time (about 10 seconds) for open and close. The valve was closed by the operator one minute and 52 seconds after the ESAS Actuation had been bypassed.

The above Sequence of Events describes the inadvertent ESAS actuation. However, the spill occurred not only as a result of the inadvertent ESAS actuation, but as a result of the inadvertent ESAS actuation coincident with the primary side of the "B" OTSG being opened for maintenance.

Operator Error Involved:

When the "A" Vital Bus was re-energized (09:01:56 in above Sequence of Events), the operator should have depressed the RC-1A HPI, RC-4A LPI, RC-1B HPI and RC-4B LPI bypass pushbuttons to return the ESAS to a three-out-of-three bypas condition. However, the operator depressed the RC-2A HPI bypass reset pushbutton (initiating the ESAS Actuation), and also the RC-3A HPI bypass reset pushbutton. There were no

conditions that would have prompted the operator to push the reset pushbuttons, nor were there any component malfunctions. It must be assumed, therefore, that the operator just made a mistake; one that was quickly corrected.

Extent of the Spill:

A calculation was made to determine the gravity drain flow rate from the BWST to the Reactor Vessel through the decay heat removal drop line. The following assumptions were made:

A. Average BWST level is 52 feet (Elevation 357'-0").

B. RCS level required for water flow past RC Pump is at Elevation 316'-0".

C. All pipe from BWST to Reactor Vessel is 12".

D. Total length of 12" pipe is 500'.

E. Relative roughness (k/D) is 0.0015 (assumes new pipe).

F. Neglect friction losses of pipe bends and valves.

The gravity flow rate calculated using the above assumptions is approximately 6500 gpm.

DH-V5A was open for no more than 2 minutes and 9 seconds. In that time, about 14,000 gallons were drained from the BWST, with about 10,000 gallons spilling on the containment building floor.

It should be noted that 2 minutes and 11 seconds elapsed from the time of the ESAS actuation to the time that

the spill was terminated. This is an indication of the prompt operator action that took place to stabilize the plant and minimize the extent of the spill.

Corrective Actions:

Following evaluation of the incident, the following steps were taken to ensure a similar event would not recur:

1. The Supervisor of Operations personally briefed each shift on the details of the incident.
2. The Supervisor of Operations revised the procedure for transferring inverters (OP-1107-2) to reflect the lessons learned from this incident.
3. The Supervisor of Operations was charged to provide more defined guidance on the actual conduct of operations for watch standers.
4. The Technical Support Group in Parsippany was contacted to review the Human Engineering aspects contributing to the causes of this incident and to recommend any feasible alternatives for the Control Console ESAS Display.
5. The PORC Chairman was charged with issuing directions to personnel involved in procedure review to ensure that personnel safety is given proper attention in procedure review.

Maintenance History of Makeup and Purification System and Once-Through Steam Generators:

During the period from January 1978 to November 1980, there were 192 job tickets/maintenance work requests initiated to perform work on the make-up and purification system. Of these 192 work requests, 94 were for valve maintenance including packing/seal leakage, internal inspection and repair, limit switch adjustment, valve operator maintenance; 34 were for filter maintenance including filter cartridge replacement; 28 were for instrumentation maintenance including calibration and repair; 16 were for pump maintenance including leakage, oil changes, electrical contactor replacement; 4 were for piping modification/repair; 3 were for letdown cooler repair/modification; 2 were for snubber inspection; 6 were duplicate job tickets, and 5 were miscellaneous, such as erecting scaffolding.

During the same period as above, there were 50 job tickets/maintenance work requests initiated to perform work on the once-through steam generators. Of these 50 work requests, 31 were for preparation for and performance of the OTSG inservice inspection program; 4 were for weeping handholes/manways; 4 were for secondary sludge removal; 4 were for instrument calibration/repair; 3 were for snubber inspection; 2 were for loose parts monitoring modifications; 2 were for change modifications for orifice plate adjustment and auxiliary feedwater nozzles.

None of the above work requests are indicative of any particular maintenance problems responsible for causing the June 27, 1980 spill.

Impact on Unit 2 Storage Facilities:

The water that was spilled was transferred to the Unit 1 Liquid Waste System (in accordance with plant operating procedures) within 20 minutes of the event. The floor was hosed down and kept wet to prevent any airborne contamination.

All of the liquid produced, both from the spill itself and from the decontamination effort, was processed by the Unit 1 Liquid Waste System. The total volume, about 12,000 gallons, was discharged after processing in accordance with station procedures. Therefore, the spill essentially had no impact on the storage facilities and no impact at all on Unit 2.