Nuclear

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057-0191
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:
(717) 948-8400

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Washington, DC 20555

Attention: Document Control Desk

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Post-Defueling Monitored Storage Safety Analysis Report,
Amendment 5

Dear Sirs:

Attached is Amendment 5 to the Post-Defueling Monitored Storage (PDMS) Safety Analysis Report (SAR) which includes Supplement 2 and revisions to the main SAR text submitted as page changes. This amendment responds to your requests for additional information dated July 14, 1989, and August 22, 1989.

Sincerely,

M B Roche

M. B. Roche
Director, TMI-2

EDS/emf

Attachment

cc: W. T. Russell - Regional Administrator, Region I
J. F. Stolz - Director, Plant Directorate I-4
L. H. Thonus - Project Manager, TMI Site
F. I. Young - Senior Resident Inspector, TMI

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falling to the tower collecting basin. The fill was composed of horizontal splash bars supported in a grid system, which broke up the water flow to increase the heat transfer rate. From there, the water flowed by gravity to the circulating water flume.

This facility has been dismantled and the combustible material has been removed.

6.1.7 MECHANICAL DRAFT COOLING TOWER

The original design of the Mechanical Draft Cooling Tower was to remove the heat added by the Service Cooling Water Systems, which included the Secondary Services River Water, before it was returned to the river. Incoming hot water was pumped from a hot water collecting basin beneath the tower to the hot water distribution basins at the top of the towers. Air entered through inlet air louvers on both sides of the tower to mix with the water falling through the fill. The cooled water was collected in the water basin under the tower.

This facility has been dismantled and the combustible material has been removed.

6.1.8 PROCESSED WATER PUMP HOUSE

The Processed Water Pump House is located between the processed water storage tanks and houses the transfer pumps, sample sink and tank isolation valves. This system and facility was installed during the cleanup period and was used to collect water from the Auxiliary Building Emergency Liquid Cleanup System.

During PDMS, all water from this facility will have been disposed of and the system will be deactivated. As such, the facility will be deactivated.

6.1.9 TENDON ACCESS GALLERY

The Tendon Access Gallery provided access for initial positioning and tightening of the Tendon Post-Tensioning System during construction. The Tendon Post-Tensioning System is grouted and as such does not require periodic torquing.

During PDMS, this facility serves no active or passive function and as such is designated deactivated.

6.1.10 RIVER WATER AND FIRE PUMP HOUSE

The River Water Pump House provided a structure for intake water supplied to the various nuclear and service water systems and the Unit 2 diesel fire pump (FS-P-1) in the adjacent Fire Pump House structure.

For PDMS, systems within these facilities are deactivated except that the diesel fire pump has been turned over to Unit 1 and is designated for emergency use only. Accordingly, the River Water and Fire Pump Houses are deactivated but provide a passive pathway for intake water to the diesel fire pump FS-P-1.

6.1.11 BWST PIPE CHASE

The Borated Water Storage Tank (BWST) Pipe Chase is an underground tunnel extending from the BWST into the Auxiliary Building on the east side. It encloses piping in the Decay Heat Removal System related to the borated water supply for the plant. It serves no active or passive function and has been deactivated for PDMS.

6.1.12 CONTROL BUILDING (M-20) AREA EAST

The Control Building Area is the plant area below elevation 305' between the Turbine, Reactor, and Service Buildings. The east portion is separated from the west by a barrier wall and houses the motor-driven Emergency Steam Generator Feed Pumps.

This area provides access to the Tendon Access Gallery on the east side and the Control and Service Buildings from the Turbine Building. It serves no active or passive function for PDMS and has been designated deactivated.

6.1.13 CONTROL BUILDING (M-20) AREA WEST

The Control Building Area west portion houses the turbine-driven Emergency Steam Generator Feed Pump, Main Steam Isolation, Relief and Atmospheric Vent Valves, the Control Building Area Sump, and Unit Substation's 2-34 and 2-44.

This area also provides access to the Tendon Access Gallery on the west side. It services no active or passive function and has been designated deactivated.

Single line diagrams of the Unit 2 AC distribution system are shown on Figures 7.2-14 through 7.2-42 and contain the following details:

a. Power supply feeders (i.e., network configuration)

b. Busing arrangements

c. Loads supplied from each bus

d. Manual and automatic interconnections between buses, buses and loads, and buses and supplies

e. Equipment capacities

f. Instrumentation and control systems for the applicable power systems with the assigned power supply identified

g. Electric circuit protection system network.

7.2.5.1.3 Evaluation

The Auxiliary Electrical Distribution System has been modified in certain areas to meet the requirements of PDMS. Due to the deactivation of the reactor and its associated support systems, Class 1E emergency diesel backed power systems are no longer required. In support of this, the emergency diesel generators have been deactivated and the Engineered Safety Feature buses no longer have connection capability to the emergency diesel generator buses 2DG-1 and 2DG-2. The Engineered Safety Feature buses will no longer be considered Class 1E. All non-PDMS support systems and components have been deactivated and isolated from the power distribution system. Administrative controls have been developed and are in place to govern the use of PDMS support systems and prevent unauthorized use of deactivated systems. Load consolidation has been performed where practical using bus tie-breakers in order to reduce the number of energized circuits which reduces plant maintenance and surveillance activities thereby enhancing overall plant safety. DC power required during PDMS is supplied through a system of rectifiers. DC back-up power supplies have been provided to support radiation monitoring and fire protection systems during a temporary loss of power.

The Auxiliary Electrical Distribution System, as modified for PDMS, will provide sufficient reliable electrical power to support all PDMS activities with enhanced overall plant and personnel safety.

7.2.5.2 Normal and Emergency Lighting

7.2.5.2.1 PDMS Function

TMI Unit 2 is provided with normal lighting systems using mercury-vapor, fluorescent and incandescent luminaries. These systems will provide illumination for PDMS support activities and for personnel safety. All lighting not required for security and monitoring activities will be turned off. Lighting will be energized as needed for maintenance activities.

Installed emergency lighting will not be maintained during PDMS. Normal lighting is available throughout TMI-2; 8-hour portable emergency lighting will be carried by emergency personnel crews entering the buildings. This lighting will be staged with emergency response crew equipment. Routine entry crews will carry flashlights.

7.2.5.2.2 System Description

The lighting system design is in accordance with the following:

a. Lighting intensity levels are as recommended in the Illumination Engineering Society Handbook.

b. Circuitry is in accordance with the National Electrical Code.

c. Exit signs are powered from the normal lighting system and from a locally mounted battery during emergency conditions.

The normal lighting system is powered from normal AC power sources. This system utilizes three types of luminaries: mercury-vapor, fluorescent and incandescent. The mercury-vapor luminaries are powered from 480/277-volt systems directly from the 480-volt unit substations or from 480-volt motor control centers. The fluorescent and incandescent luminaries are powered from 208/120-volt systems utilizing 30 KVA step-down transformers which are supplied from the 480-volt sources. In general, the mercury-vapor luminaries are used in high ceiling areas, the fluorescent luminaries in almost all other areas, and the incandescent luminaries where environmental conditions require their use.

Special lighting is provided in the Control Room and Diesel Generator Building as part of the normal lighting system. The Control Room fluorescent lighting and the Diesel Generator Building fluorescent, and incandescent lighting are powered from lighting panels (480/277-volt) and from step-down transformers and power panels (208/120-volt) which are supplied from the 480-volt ESF buses.

7.2.5.2.3 Evaluation

The majority of the existing lighting systems remain operational during PDMS. They provide sufficient lighting capability for anticipated support activities. If further needs arise, temporary lighting will be added for specific PDMS activities.

7.2.5.3 Communications System

7.2.5.3.1 PDMS Function

The TMI-2 Communications System during PDMS will provide normal communication channels throughout Unit 1 and Unit 2.

In addition, the Communications System will provide the capability to announce alarms and alert personnel to radiation and fire hazards.

7.2.5.3.2 System Description

Portions of the original system have been retained for PDMS as follows:

a. Normal Page - Party System

   This system is powered from a separate 120-volt, single-phase AC power bus. The system is compatible with TMI Unit 1 and was merged with the TMI Unit 1 system through a merge-isolate switching arrangement in the control room to provide normal communication channels throughout TMI Units 1 and 2 during PDMS.

   The system consists of handsets, amplifiers, loudspeakers, evacuation tone generator, isolating transformer, and the necessary special equipment to provide a paging channel and three party line channels.

b. Emergency Page - Party Line System

   This system operates in a manner similar to the Normal Page - Party Line System described above except that this system has only one party line. All the equipment currently is painted red and is available for use throughout Unit 2.

c. Maintenance and Instrumentation Telephone System

   This system consists of three separate networks: one in the Turbine Building; one in the Containment, Control Room and Service Building; and one in the Auxiliary and Fuel Handling Buildings. The main purpose of this system is to facilitate the inspection, calibration and testing of instrumentation in the panels and transmitter racks. The amplifiers are powered from a separate power bus.

d. Commercial Telephone System

   This system's trunk lines, handsets and switching equipment are installed by, and leased from, the Bell Telephone Company. This

12. Section 6.17 - Mechanical Draft Cooling Tower. "Fire Protection for the wood portion of cooling towers will remain operational to mitigate consequences of a fire."

13. What type of fire protection system is in place? What methods are used to avoid pipe damage as a result of freezing temperatures?

RESPONSE: (The correct reference is to Section 6.1.7.)

The Mechanical Draft Cooling Tower and the two (2) Natural Draft Cooling Towers will be dismantled and the combustible material removed prior to entry into PDMS. PDMS SAR Sections 6.1.6 and 6.1.7 have been revised accordingly.

SUPPLEMENT 2

RESPONSES TO USNRC REQUESTS FOR

ADDITIONAL INFORMATION, DATED A. JULY 14, 1989

AND B. AUGUST 22, 1989

A.1. What system has been established to verify continued maintenance of isolation of the areas and components that assure subcriticality?

RESPONSE: The current TMI-2 Technical Specifications state that Facility Mode 2 "shall exist when the following conditions are met:

a. The Reactor Vessel and Reactor Coolant System are defueled to the extent reasonably achievable.

b. The possibility of criticality in the Reactor Building is precluded.

c. There are no canisters containing core material in the Reactor Building."

Demonstration that these conditions have been met will be contained in the TMI-2 Defueling Completion Report (DCR) which will justify the license change from the current Facility Mode 1 to Facility Mode 2. The DCR will provide information regarding any inspections or monitoring necessary during PDMS to ensure subcriticality. Therefore, the subject of criticality will have been resolved long before TMI-2 enters Post-Defueling Monitored Storage (Facility Mode 4).

Subcriticality at TMI-2 during monitored storage will be assured by at least two (2) independent means in all fuel locations. Outside of the Reactor Vessel, there is far less than a critical mass in any single location. In addition, transport of material from one location to another is precluded by the drained state of the Reactor Coolant System. Finally, closed containment isolation valves will prevent transport of fissile material between the Reactor Building and the Auxiliary and Fuel Handling Buildings.

In the Reactor Vessel, subcriticality will be ensured as described in Section 5.4 of the TMI-2 Defueling Completion Report. Once again, transport of fissile material to or from the Reactor Vessel is inhibited by the drained state of the Reactor Coolant System.

A.2. Is the Reactor Vessel to be sealed prior to PDMS? If the indexing fixture and shielded work platform are to remain in place, what is the expected dose rate from radiation (both direct and scattered) on the 305 ft. and 347 ft. levels?

RESPONSE: The Reactor Vessel will be covered but not sealed. Current plans are to provide a cover that controls the spread of contamination and prohibits water ingress but permits hydrogen egress via a vent.

Calculations have been performed to assess the radiation profiles at the defueling work platform and refueling canal once the Reactor Vessel has been drained. The analysis indicates that dose profiles will be overwhelmingly governed by Cobalt-60 activation of the baffle plates. Dose rate contributions from residual fuel and Cesium-137 surface contamination are expected to be negligible. Shine and backscatter are also expected to be negligible since the distance between the radiation source and the nearest solid object (i.e., the polar crane) is over 100 ft. With the Reactor Vessel drained and the indexing fixture and shielded work platform in place, the expected general area radiation levels for the 305' elevation will remain unchanged from present day levels (i.e., an average of 35 to 135 mr/hr) with possible dose rate increases in isolated areas due to radiation streaming through biological shield penetrations and loss of self-shielding from overhead piping. Assuming no shielding, the radiation levels are up to 20 R/hr for elevation 331'-6", and up to 2-1/2 R/hr for elevation 347'-6". However, we intend to shield to meet the dose rate goals stated in PDMS SAR Table 5.3-1.

A.3. What are the locations of the fire system hose and reels that will be operational during PDMS?

<u>RESPONSE</u>: All of the fire service hoses and hose reels will remain operational during PDMS. The fire service supply to the hoses and hose reels will be isolated via external yard valves (Ref: PDMS SAR Figure 7.2-3), but will be capable of being placed into service, as needed, by re-aligning two (2) valves: a yard isolation valve and the hose/hose reel isolation valve. Additionally, containment isolation valves must be operated in the event of a fire inside containment. Personnel responding to combat a fire will have been trained on the operation of the fire service supply system.

A.4. Will emergency lighting be maintained in the Service and Turbine Buildings during PDMS?

RESPONSE: Installed emergency lighting will not be maintained during PDMS. Normal lighting is available throughout TMI-2; 8-hour portable emergency lighting will be carried by emergency personnel crews entering the buildings. This lighting will be staged with emergency response crew equipment. Routine entry crews will carry flashlights.

PDMS SAR Section 7.2.5.2 has been revised accordingly.

A.5. Has a decision been made as to dismantling the redwood cooling tower?

<u>RESPONSE</u>: The Mechanical Draft Cooling Tower and the two (2) Natural Draft Cooling Towers will be dismantled and the combustible material removed prior to entry into PDMS. PDMS SAR Sections 6.1.6 and 6.1.7 have been revised accordingly.

A.6. What is the status of procedure development for putting FS-P-1 fire pump in/out of layup or standby?

<u>RESPONSE</u>: FS-P-1 has bee turned over to Unit 1 and is designated for emergency use only. The automatic start feature has been disabled and starting of the pump is through manual operation. Operating procedures have been implemented and are in place. PDMS SAR Section 6.1.10 has been revised accordingly.

A.7. Have you considered the possibility and effects of radiolytic generation of hydrogen and/or nitric acid in the Reactor Vessel?

<u>RESPONSE</u>: See the response to Question B.2.

B.1. Provide calculations and evaluations of radiation levels from reactor vessel, (shine and backscatter) to the containment.

<u>RESPONSE</u>: See response to Question A.2.

B.2. Provide an evaluation of radiolytic generation of hydrogen and nitric acid in reactor vessel and its potential impact.

RESPONSE: The Reactor Vessel will be in a drained condition during the PDMS period. Having a drained Reactor Vessel will significantly reduce the quantity of hydrogen and aqueous nitric acid generated via the radiolysis of water. Although we expect the impact to be negligible, we are performing an evaluation to verify this assumption. This evaluation will be submitted when it becomes available.

B.3. Provide additional information on the integrity and surveillance of welded and bolted flanges on containment penetrations.

RESPONSE: Flange degradation due to corrosion, fatigue failure, and damage from tampering have been considered and are addressed as follows:

- Corrosion - The flanges used on containment penetrations are of either stainless steel or carbon steel construction. In the case of stainless steel flanges, the material selection was made primarily on the corrosion resisting properties of stainless steel. Carbon steel flanges which form a containment isolation boundary (as well as stainless steel flanges) are located indoors and, as such, are not subjected to conditions which would tend to accelerate corrosion. In addition, piping systems that penetrate containment have been drained to the extent practical to minimize the corrosion rate. Therefore, flange degradation due to corrosion is not a significant concern.

- Fatigue Induced Failure - The systems containing containment penetrations are de-activated and, thus, are subjected to only ambient pressures and temperatures. Therefore, flange degradation due to fatigue failure is not a significant concern.

- Damage From Tampering - The plant will remain under surveillance by a combined Unit 1/Unit 2 security force to preclude the intrusion of unauthorized persons. Authorized personnel entry will be closely controlled. Therefore, flange degradation due to damage from tampering is not a significant concern.

Despite the unlikelihood that any type of flange failure would occur, welded and bolted flanges which form a containment isolation boundary will be visually inspected for signs of degradation and/or leakage every five (5) years during PDMS.

B.4. Provide additional detailed information on methodology for the determination of release rates and effluent concentrations for containment and AFHB gaseous effluents during passive mode conditions.

RESPONSE: Response to be provided later.

B.5. Provide additional information on pest control for the AFHB during PDMS.

RESPONSE: GPU Nuclear maintains a contract with a local pest control service which covers insect, rodent, and spider control, bird control, and live animal removal. Services are provided both on a routine basis and on an on-demand/complaint basis.

B.6. Provide the basis that will assure containment isolation for penetrations which currently use check valves as a single closure for the containment boundary.

RESPONSE: There is no containment penetration that uses a check valve as a single closure for the containment boundary. TMI-2, pre-PDMS, Technical Specification Table 3.6-2 identifies 25 penetrations which utilize a check valve as an inside containment isolation valve. While the Technical Specification table is correct, it should not be interpreted that the check valve will be used as the sole containment isolation valve during PDMS. Table B-1 lists those 25 penetrations and their associated outside containment isolation valves, which in no case is a check valve. Note that only the main line valves are listed, the vent and drain valves also will be shut during PDMS.

TABLE B-1

Penetration No.	Outside Containment Isolation Valve
R573	MU-V-379
R574	MU-V-380
R575	MU-V-381
R576	MU-V-382
R577	RR-V-5A
R579	RR-V-5B
R584	RR-V-6D
R587	RR-V-6E
R580	RR-V-5C and 6C
R583	BS-V-1B and 130B
R586	BS-V-1A and 130A
R589	DH-V-4A
R590	DH-V-4B
R591	MU-V-16C
R592	MU-V-16D
R537	CF-V-114B
R539	DC-V-103
R542	DH-V-187
R544	CF-V-114A
R557	NS-V-72
R559	IC-V-5
R563	IC-V-4
R566	SA-V-20
R570	MU-V-16A
R572	MU-V-16B

B.7. Provide flowpath, methodology for inplace DOP testing, and clarification of size and location of HEPA filter in atmospheric breather for containment.

<u>RESPONSE</u>: Refer to PDMS SAR Figure 7.2-2. The Hydrogen Control Exhaust Unit will be used as the Reactor Building passive breather. Filter position AH-F-33 will contain a 24" x 24" x 11 1/2" HEPA. All other filter positions will be empty.

The Reactor Building passive breather may be operated in the following modes:

- <u>Passive Breathing</u> - AH-V-3A, AH-V-52, and AH-V-225 will be open and AH-V-4A, AH-V-120A, and AH-V-36 will be closed. A filter housing door downstream of AH-F-33 will be opened. In this configuration, the Reactor Building will be allowed to naturally aspirate via a HEPA-filtered pathway to the Auxiliary Building which, in turn, naturally aspirates with the environment through yet another set of HEPA filters.

- <u>DOP Testing</u> - AH-V-32, AH-V-52, AH-V-25, and AH-V-36 will be open. AH-V-4A, AH-V-120A, and the filter housing door, which would be open during passive breathing, will be closed. As the Hydrogen Control Exhaust Fan, AH-E-34, is operated, DOP is injected upstream of AH-F-33 and sampled downstream using ports which will be installed later.

B.8. Provide estimates of the total activity remaining in the Auxiliary Building, the Fuel Handling Building, and in each of the seven (7) other contaminated facilities at TMI-2.

RESPONSE: The estimated total activity present as loose surface contamination in the AFHB and the seven (7) other contaminated facilities at TMI-2 upon entry into PDMS is given in PDMS SAR Tables 5.3-5 and 5.3-6 as being less than 0.05 curies. This is the total inventory available for release due to an accident. There may be additional radioactive material contained in closed systems within those areas that is not available for release. However, there will certainly be less material than was once considered for in-place storage of the Makeup and Purification (MU&P) demineralizer resins for which an accident analysis has been performed.

The MU&P demineralizer accident analysis assumed the following:

1. One demineralizer vessel ruptures non-mechanistically and spills its contents on the cubicle floor;

2. There is 0.5 kg of fuel contained in the ruptured demineralizer;

3. The isotopic inventory includes approximately 100 curies of Strontium-90 and 530 curies of Cesium-137; and

4. The airborne release fraction is 1×10^{-4}.

Three (3) cases were considered for the transfer of this airborne activity from the Auxiliary Building (AB) to the environment: AB ventilation system operating; AB at negative pressure; and AB under passive ventilation. The worst case calculated off-site dose to the critical organ of the maximally exposed individual resulting from this postulated release is 0.45 mrem. For this dose analysis, the critical organ is the bone of a teenage individual via the inhalation pathway. This dose consequence is less than the dose calculated for the worst-case unanticipated event in PDMS SAR Section 8.2 which is a vacuum canister failure.

Therefore, the small amount of radioactive material contained in the AFHB and the seven (7) other contaminated facilities at TMI-2 is of minor consequence.

B.9. Will the HPR-219A or HPR-219 effluent monitor be used during PDMS for monitoring the station vent?

RESPONSE: During Reactor Building ventilation system operation (i.e., Reactor Building purge), the station vent stack monitor, HP-R-219 or HP-R-219A, will provide real-time monitoring of releases. During periods when the containment ventilation systems are not operating, the containment will be passively vented to the environment through a breather pathway which will be filtered using a HEPA filtration system. During passive breathing, operation of the radiation monitors is not appropriate.

B.10. Provide the PDMS disposition of the oil reservoir in the Unit 2 Turbine Building.

RESPONSE: The ultimate disposition of the oil reservoir in the TMI-2 Turbine Building is as yet undetermined. However, the fire potential represented by this oil reservoir is of no consequence with respect to release of radioactive material off-site since there is no inventory of radioactive material available for release due to a fire in this area.

B.11. Describe the air flow pathways between the Auxiliary Building and the Fuel Handling Building during PDMS.

<u>RESPONSE</u>: Refer to PDMS SAR Figures 1.2-8, 9, 10, and 11.

The TMI-2 Fuel Handling Building is a four floor building which shares a common wall with the TMI-2 Auxiliary Building. On all levels, there are personnel doors which allow passage through the common wall. The doors on the first three floors between the TMI-2 Fuel Handling Building and the TMI-2 Auxiliary Building (i.e., El. 280', 305', and 328') will remain open to allow free air passage between the buildings.

The TMI-2 Fuel Handling Building also shares a common roof and west wall with the TMI-1 Fuel Handling Building. The building space above the 347' elevation is common to TMI-1 and TMI-2 as is the Truck Bay (El. 305') and the Standby Pressure Control (SPC) pit (El. 328'). However, the doors from the TMI-2 side which access the Fuel Handling Building volume common to both TMI-1 and TMI-2 will be closed, limiting the supply of air from the TMI-2 side. Dampers will be shut; wall and floor penetrations are fire sealed. The Fuel Handling Building volume common to both TMI-1 and TMI-2 will be maintained at a slightly negative pressure by the TMI-1 Fuel Handling Building ventilation system. Air flow from the TMI-2 side is expected to be negligible due to the lack of supply air.