Nuclear

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TMI-2 Cleanup Project Directorate
Attn: Dr. W. D. Travers
Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057

Dear Dr. Travers:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Reactor Building Sump Criticality Safety Evaluation Report

Attached are GPU Nuclear responses to your comments regarding the Reactor Building Sump Criticality Safety Evaluation Report.

Sincerely,

F. R. Standerfer
Vice President/Director, TMI-2

FRS/CJD/sle

Attachment

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NRC COMMENT 1:

What information is available regarding the amount of fuel under the reactor vessel? What further information gathering do you plan and what is the schedule for gathering this information?

GPU NUCLEAR RESPONSE:

One indication of the amount of fuel under the reactor vessel (RV) is the radiation levels measured during the ion chamber probing of the RV lower head via the the incore instrumentation tubes. The ion chamber measures the gamma flux that would be associated with fission products under the RV. The initial ion chamber probe of the RV lower head was performed on March 22, 1985. The results of that probe showed a general area exposure rate of approximately 17 R/hr to 23 R/hr in the air space of the cavity below the RV. Additional measurements using the ion chamber probe via different incore instrumentation tubes, were performed on March 20-21, 1986. The results of this probe indicated a general area exposure rate decrease from about 9 R/hr at the outer surface of the RV to about 4 R/hr at the location where the incore guide tube became submerged in the approximately two (2) feet of water which was covering the basement floor at the time of the probe. These exposure rates are generally consistent with other RB basement exposure rates and are not indicative of the presence of significant quantities of fuel.

The exposure rates measured by the ion chamber in the sections of the guide tubes submerged under water are inconclusive. These exposure rates ranged from 0.37 R/hr to 0.86 R/hr. If a mass of fuel was submerged on the basement floor, the attenuation of the gamma flux by the water would most likely preclude meaningful monitoring of such a mass by this technique.

If a significant mass of fuel had flowed from the RV lower head, it most likely would have left deposits on cavity components; i.e., concrete walls, incore monitoring piping and pipe hangers, and the reflective insulation and its support steel. A significant distribution of source material in close proximity to the incore instrumentation tubes which were scanned would have resulted in higher exposure rates than were detected by the ion chamber.

Based on the exposure rates measured by the ion chamber probes in the air space of the cavity under the RV, GPU Nuclear has concluded that there is not a significant mass of fuel under the RV.

Currently, GPU Nuclear does not have a specific schedule for further examination of the area directly under the RV.

NRC COMMENT 2:

Page 8 of your SER states that "no known mechanism is available for establishing flow across the basement floor". How do you discount the force of steam/two phase flow from the RCDT as a driving force and the flow from decontamination spray water?

GPU NUCLEAR RESPONSE:

Neither the force of steam/two phase flow from the RCDT during the accident nor the flow from decontamination spray would be capable of establishing flow across the RB basement floor. In the first case, the RCDT rupture disc discharge is a 18 inch diameter pipe which vents into the RB approximately 17 feet above the basement floor in the vicinity of the open stairwell and the RB liner. An analysis of the accident demonstrates that the discharge from the Reactor Coolant System (RCS) through the RCDT resulted in a 2 - 3 inch accumulation of water on the floor of the basement prior to fuel failure. Further, if the flow out of the RCDT discharge had been primarily water during the period of fuel failure, analysis indicates it would have exited from the pipe at a low velocity. The reservoir of water on the basement floor would have dissipated the force of the flow from the RCDT discharge pipe as it hit the basement floor. For example, at a five (5) foot radius from the impact point of the discharge, the flow rate of the reservoir would have been about 0.1 ft/sec.

If the flow out of the RCDT discharge had been primarily steam, it would have exited from the discharge pipe and impinged on the RB liner approximately 12 feet away. The steam would have either condensed on the RB liner and/or structural steel in the area and rained down the RB liner wall to the basement or the steam would have moved as a vapor cloud to areas below the 305 foot elevation of the RB.

For the second case, potential flow established by decontamination spray water, the flow rates used during the flush of the RB basement walls were insufficient to establish flow across the basement floor. Typically, decontamination flow rates were 5 - 10 gallons per minute with a peak of 25 gallons per minute. This water was sprayed onto the basement walls from the 305 foot elevation of the RB via nozzles placed through the seismic gap. In addition to the low flow rates used and the large area in which the water was dispersed, most of the RB basement floor was covered with water which would have dissipated the force of impact of the decontamination spray water. Therefore, flow across the basement floor would not have been established.

NRC COMMENT 3:

What data demonstrates that molten fuel did not penetrate incore instrument guide tubes and drop into the sump with the remainder of the molten material re-solidifying and sealing the leakage path?

GPU NUCLEAR RESPONSE:

There is no data to suggest that this sequence of events occurred. As stated in the response to the first comment, the ion chamber probes of the RV lower head via the incore instrumentation tubes indicate radiation levels in the cavity below the RV which do not support this postulate.

In addition to the radiation measurements which have been performed, the integrity of the RV lower head has been reassessed. The thermal hydraulic and structural properties of the RV lower head during the accident were analyzed. Since the RV demonstrated significant pressure retaining capability, it is considered highly unlikely that any significant melting or distortion of the RV lower head, including the incore nozzles, occurred during the accident.

NRC COMMENT 4:

By what method would you detect an inadvertent criticality in the sump?

GPU NUCLEAR RESPONSE:

GPU Nuclear considers a criticality in the RB basement to be a highly unlikely event. The evaluations and measurements performed to date demonstrate that there is insufficient fuel in the RB basement to support a criticality. GPU Nuclear considers the need for criticality detection in the RB basement to be nonexistent. Therefore, there are no instruments specifically installed to detect a criticality in the RB basement.

Although there are no instruments installed directly in the RB basement for criticality detection, the RB Purge and the Station Vent radiation monitors are available. These monitors detect gaseous fission products that are drawn through the RB ventilation system. An alarm from these monitors would be responded to in accordance with approved plant procedures.

NRC COMMENT 5:

If an inadvertent criticality occurred what remediant actions are available?

GPU NUCLEAR RESPONSE:

As mentioned previously, GPU Nuclear considers a criticality event in the RB basement to be a highly unlikely event. This is based on the evaluations and measurements performed to date which demonstrate that there is insufficient fuel in the RB basement to support a criticality. However, in the unlikely event it should become necessary, flooding of the RB basement with borated water can be accomplished. Borated water can be injected into the basement from the Borated Water Storage Tanks (BWST) by opening the downstream valves DH-V-5A and 6A or DH-V-5B and 6B. These valves are operated from within the Control Room and provide a direct path from the BWST to the RB basement. This injection of highly borated water can increase the boron concentration in the basement to $\geq$4000 ppm and would ensure the maintenance of subcriticality.