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NRC/TMI-83-043
July 13, 1983

Docket No. 50-320

Mr. B. K. Kanga
Director, TMI-2
General Public Utilities
P. O. Box 480
Middletown, PA 17057

Dear Mr. Kanga:

Subject: Reactor Vessel Underhead Characterization Safety Evaluation

References: (a) B. K. Kanga letter to L. H. Barrett, 4410-83-L-0040, Underhead Characterization Study, dated May 19, 1983

(b) B. K. Kanga letter to L. H. Barrett, 4410-83-L-0098, Underhead Characterization Study, dated May 25, 1983

(c) B. K. Kanga letter to L. H. Barrett, 4410-83-L-0100 Underhead Characterization SER, Core Topography Addendum, dated May 26, 1983

(d) L. H. Barrett letter to B. K. Kanga, NRC/TMI-83-034, Review of Underhead Characterization Safety Evaluation Report, dated June 2, 1983

(e) B. K. Kanga letter to L. H. Barrett, 4410-83-L-0128, Review of Underhead Characterization SER, dated June 29, 1983

This letter is in response to the letters referenced above in which you forwarded Safety Evaluation Reports (SER) to support the next phase of the reactor vessel Underhead Characterization Study. References (d) and (e) include fourteen NRC questions related to these SER's and your responses respectively.

Prior to performing the Underhead Characterization Study, the primary system will be depressurized and the water level will be drained in stages to a level approximately ten feet above the reactor core. A similar sequence of events was performed during the initial underhead characterization study which was completed in December 1982. During the first characterization, primary system water was lowered below the control rod drive mechanism (CRDM) pressure seals. In the proposed study the water level will be lowered one foot below the top

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of the reactor vessel plenum, approximately ten feet lower than the level which was used during the initial study.

In our review of the referenced documents we focused on the differences between the completed operation and the one which is proposed. During the proposed Underhead Characterization Study you plan to perform the following activities:

1. Obtain dose rates around the head and service structure as the primary water level is lowered.

2. Open the primary system to the reactor building environment by removing the center control rod drive mechanism (H-8).

3. Working through the opening created by the removed CRDM, you plan to collect the following data:

   a. Gamma and Beta/Gamma surveys inside the reactor vessel using an ionization chamber and TLD strings.

   b. Perform visual inspection inside the reactor vessel using a closed circuit television system.

   c. Obtain debris samples from the top of the plenum.

   d. Obtain a topographical outline of the core damage using an ultrasonic survey device.

   e. Obtain a core debris samples (this evolution will be addressed by a separate SER).

Following the Underhead Characterization Study, you plan to leave the reactor coolant system in a depressurized, partially drained condition. You have agreed in reference (e) to provide a contingency closure for the CRDM orifice. We expect that the contingency closure will be ready for use prior to removing the CRDM. The contingency closure should be manufactured in a manner to provide reasonable assurance that if required, it could maintain leak tight integrity when pressurized to at least 100 psig.

In our review of potential hazards associated with the Underhead Characterization Study, we considered inadvertent criticality, worker and general public exposure, decay heat removal, pyrophoric reactions, and gas generation. Of the issues considered, the pyrophoric reaction was one which had not been analyzed to support previously completed operations at TMI. The other identified potential hazards, had been analyzed previously in the Quick Look SER and verified to some degree during the initial underhead characterization study. Based on this previous work there is a high level of confidence that these potential hazards will not present a problem during the proposed characterization study.

The concern over worker and general public exposure was analyzed for the unique conditions which will result when reactor water level will be lowered

for the first time to expose large surface areas inside the reactor vessel. We conclude that your dose rate estimates and the estimate for the total personnel exposure (15-16 man-rem) for the Underhead Characterization Study are reasonable, based on the currently available information. The proposed dose rate monitoring program, which will be in effect during the time reactor water level is being lowered, will provide an adequate early indication of any dose rates higher than those projected.

The potential for an increase in airborne particulate activity was addressed in item 7 of reference (e). This analysis concluded that based on partial vapor pressures and humidity, particles small enough to present a potential airborne problem will remain moist during the time that the interior of the reactor vessel is open to the reactor building atmosphere. It is our position that unknown conditions under the reactor vessel head coupled with an extended duration during which the reactor vessel interior surfaces will be exposed to air, warrant a contingency system to ensure that any airborne particles generated in the reactor vessel will be segregated from the reactor building ambient air. Such a contingency system would protect the reactor building surfaces from recontamination and would provide an additional level of protection from airborne radiation to workers and the general public. Accordingly, we will require that you provide such a system prior to opening the reactor coolant system to the reactor building atmosphere. We have discussed this with your staff and understand that such a contingency system is being planned.

The pyrophoric concern involves the phenomenon of spontaneous combustion of small pieces of zirconium, zirconium hydride, and partially oxidized zirconium. The pyrophoric reaction does not initiate under water. However, once initiated in air, the reaction can continue under water. The potential for this reaction to occur, once the top surface of the plenum is exposed to air, has been evaluated extensively by GPU, various consultants, and the NRC.

The NRC review has concluded that the primary system flow dynamics during the 1979 accident were unlikely to transport large quantities of pyrophoric material to the top of the plenum. If such material were transported to th void under the reactor vessel head, it would oxidize sufficiently to render it non-pyrophoric. As a precaution, prior to lowering the reactor water level below the plenum, a closed circuit television inspection will be made of a portion of the top surface of the plenum. If any material is present on the surface of the plenum, a sample of the material will be obtained and analyzed for pyrophoricity. The decision to lower the water level below the top of the plenum will be based on the results of the visual inspection and sample analysis.

Safety evaluations for inadvertent criticality, decay heat removal, and combustible gas accumulations were performed for previous evolutions and the results of these evaluations combined with actual measurements and observations have provided a high degree of confidence that these issues can be adequately dealt with during the proposed Underhead Characterization Study. The concern over inadvertent criticality is based on the potential for boron dilution events. Procedural controls, periodic chemical analysis, piping system isolations, and primary system level monitoring will be systematically performed to ensure against boron dilution.

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We conclude that the Underhead Characterization Study can be completed in a safe manner and that the environmental impacts from the proposed operation fall within the scope of activities previously considered in the Programmatic Environmental Impact Statement. The proposed experiments are vital to the next phase of the cleanup and the proposed methods and techniques to obtain the data appear to meet the principles of ALARA and can be performed without measurable risk to the workers or the general public. Individual tasks to conduct the Underhead Characterization Study will be performed in accordance with procedures reviewed and approved by the NRC THI Program Office.

Signed William Travers for

Lake H. Barrett
Deputy Program Director
THI Program Office

cc: J. Barton
J. Larson
J. Byrne
J. Chwastyk
E. Wallace
R. Freemerman

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SURNAME	GKanga:wa	[illegible]	LHBarrett				
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