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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
Use of Debris Canisters

The purpose of this letter is to inform you of GPU Nuclear's plan to utilize modified fuel canisters as debris containers for removing fuel assembly upper end fittings, control component spiders, or other structural material from the TMI-2 Reactor Vessel. This activity will be performed to expedite access to the vacuumable fuel and debris in the core. The placement of end fittings into normal fuel canisters is more time consuming than had been anticipated and potentially may impact shipping schedules. Loading of the structural debris into normal canisters for shipping may be accomplished at a later date without impacting fuel shipping schedules.

The planned activities are not described in the current versions of the Defueling Canister TER or Early Defueling SER. Thus, they are not approved within the current scope of defueling. This letter is intended to show that these activities are bounded by those documents and can proceed safely.

The debris containers are similar in outside design to the fuel canisters described in the Canister TER except for the upper closure head and the number of bolt holes. Additionally, the debris canisters are not required to have the internal boral plates, concrete filler, recombiner catalyst, or dewatering capability.

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The bulkhead opening will be enlarged to facilitate loading of end fittings or other structural material. The enlargement is limited to allow usage of existing closure heads. As a method of differentiating these canisters from fuel canisters, four of the eight bolt holes on the container and closure head have been eliminated. Additionally, the closure vent valves will not be installed and to permit continuous venting of the containers and avoid internal pressurize buildup. The debris containers will be partially assembled on site using spare or rejected parts from the canister vendors. The assembly will use site-approved welding procedures.

During loading, the use of the seal cover will be eliminated. This will aid in identification of the type of container as well as facilitating end fitting loading. After the debris containers are loaded, they will be closed and stored in the Fuel Pool A Storage Racks until final dispositioning of the containers and their contents. Currently there are no plans to utilize these debris containers for shipment. If this course of action is considered, separate Licensing submittals will be required.

The major safety issues for the proposed activity are criticality control, hydrogen generation and pressurization of the container, lifting and handling, fuel pool contamination, and prevention of inadvertent shipment of the debris containers.

Potential criticality concerns have been evaluated and found to be bounded by the RCS Criticality Analysis (Reference 1) and the criticality analysis performed for reflecting material surrounding the core (Reference 2). When the containers are being loaded in the reactor vessel or temporarily stored in either the fuel transfer canal or spent fuel pool "A", they will be submerged in water having a boron concentration of at least 4350 ppm. Since the containers are vented, the boron concentration of the water within the containers was assumed equal to that of the surrounding water. Previous analyses (Reference 1) have demonstrated that the core will remain shutdown, with a Keff $\leq$0.99, when the RCS water is borated to a concentration of at least 4350 ppm. Although differences exist between the assumptions used in the Reference 1 analysis and those that would actually be used for an explicit analysis of submerged containers, direct application of the Reference 1 results to this evaluation are conservative. The differences are noted here to demonstrate this conservatism:

- o The reference model included the entire core. With containment of quantities of fuel significantly smaller than the core, the containers experience significantly more neutron leakage. Thus, the Keff is reduced.

- o The reference model did not consider structural material; whereas the majority of the containers' inventory will be comprised of structural material. Previous analyses have shown that structural material, such as the stainless steel in end fittings, tends to act as a neutron poison; Keff would be reduced if the structural material was considered.

Therefore, based on the results of the Reference 1 analysis and the conservatisms mentioned above, it can be concluded that the containers will be critically safe (Keff $\leq$0.99) when one or more containers are submerged in water and the containers contain water that has a boron concentration of at least 4350 ppm.

When the containers are within the canister transfer shield (CTS), the lead and steel walls of the CTS will act as an additional neutron reflector, tending to increase Keff. To demonstrate that the containers will be critically safe when within the CTS, the analyses of References 1 and 2 are used. In Reference 2, a 65-cm (25.6-inch) thick lead shell is applied to the outside of the core region. The resultant increase in Keff was 0.03% Δk. Though this analysis was completed for a boron concentration on 4950 ppm, the increase in Keff is expected to be similar for a 4350 ppm boron concentration. If this increase is added to the Keff of 0.9896 calculated for the core at 4350 ppm (Reference 1), the resultant Keff is still below 0.99. Consequently, it was demonstrated that the entire core would remain critically safe after the addition of a 65-cm thick lead reflector.

Additional conservatisms to be considered when this result is applied to containers within the CTS include:

- o The CTS walls are significantly thinner (approximately 6.5-inches) than the 25.6-inch shell. This would tend to reduce neutron reflection and thus reduce the increase in Keff.

- o The actual boron concentration of the RCS will be administratively maintained $\geq$4950 ppm. Technical Specifications require the water in spent fuel pool "A" to have a minimum concentration of 4350 ppm boron; however, it is expected that the fuel transfer canal and spent fuel pool "A" will be operated at approximately 4500 ppm boron. Any concentrations greater than 4350 ppm will cause a reduction in Keff below the value calculated in Reference 1.

- o The Reference 1 value of Keff was determined assuming the presence of an eight-inch stainless steel reflector on the outside of the core; thus, the neutron leakage has already been reduced.

Since it has been demonstrated that the entire core will remain critically safe after the addition of a 65-cm thick lead reflector and that additional conservatisms tend to reduce Keff even further, it is concluded that the containers will remain critically safe when within the CTS.

The above conclusions were reached independent of the containers' fuel inventory; thus, no restrictions are required regarding the amount of fuel loaded into the containers. However, efforts being made to limit the amount of fuel entering containers include: limiting fuel rod end stubs to approximately two (2) inches and limiting debris to structural materials with no significant quantities (i.e., chunks or agglomerations) of unidentifiable material attached. Thus, the containers are expected to contain no

significant quantities of fuel. Additionally, in order to ensure that the Keff of the defueling canisters located in the storage racks remain below the licensing criteria, debris containers will be segregated from defueling canisters in the Fuel Pool "A" storage racks by at least one space in all directions.

The presence of fuel in a container could result in radiolytic decomposition of the water within the containers. Given the minimal amount of fuel in each container, the hydrogen generation rate is expected to be minor. With the container vented, the minor amounts of gas generated will be readily released to the fuel pool water and hence to the Fuel Handling Building Ventilation System. No pressure build-up within the container can occur.

Venting the container to the fuel pool water also presents a potential for contamination of the pool water. However, the large dilution afforded by the 230,000 gallons in the pool greatly reduces the significance of this potential. If all the water in a container was released to the fuel pool, the Cesium-137 activity in the pool water would increase less than 2.2×10^{-4} μCi/ml per container. This is based on an assumed activity of 0.5 μCi/ml in the RCS coolant water entrained in the container.

A loaded debris container filled with water will weigh approximately 2000 pounds; considerably less than the maximum weight of a loaded fuel container; i.e., 3350 pounds. All lifting and handling of the container will utilize equipment and procedures for the maximum weighted fuel canister; consequently, there are no additional lifting and handling safety concerns. The debris container will be positioned in the "carousel" or the single canister support bracket for loading. After loading, the debris container will be transferred to the upender utilizing the Canister Handling Bridge and normal handling equipment. The container will be stored in the Fuel Handling Building canister storage racks. Since these containers will not have the relief valves installed, the prerequisite to canister shipping (i.e., dewatering and determination of gas generation rate) will not be possible. This will, therefore, prevent inadvertent shipment of the container.

Although the planned activities are not within the scope of the previously approved SER and TER, GPU Nuclear has determined that they are bounded by the safety evaluations. Therefore, subject to NRC concurrence, GPU Nuclear intends to proceed with the proposed activity and will update the Defueling Canister TER and Defueling SER, as appropriate.

Sincerely,

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

FRS/RBS/eml

REFERENCES

1. Criticality Report for the Reactor Coolant System, GPU Nuclear letter 4410-85-L-0199, dated November 08, 1984, from F. R. Standerfer to B. J. Snyder.

2. Report on Foreign Materials in the TMI-2 Reactor Coolant System, Reference 22 to the Early Defueling Safety Evaluation Report, Revision 4, GPU Nuclear letter 4410-85-L-0200, dated October 10, 1985, from F. R. Standerfer to B. J. Snyder.