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
Storage of Upper End Fittings

The purpose of this letter is to describe the GPU Nuclear proposal to use shielded 55 gallons drums to store end fittings and other structural material removed from the reactor vessel (RV). This course of action is being proposed since unsized end fittings are not easily loaded into the fuel canisters and, at present, no need exists to adequately size the end fittings in the RV. Consequently, end fittings are frequently moved from place-to-place in the core to avoid active defueling regions. Removal of the end fittings from the RV would facilitate defueling since multiple moves delay defueling. It is estimated that removing the end fittings, as proposed will shorten the defueling time by approximately 8 weeks since sizing of the end fittings will be accomplished external to the RV. The details of this activity will be the subject of future correspondence with the NRC as plans are further developed.

To remove the end fittings from the RV, GPU Nuclear proposes that the end fittings be lifted from the RV and placed in 55 gallon drums. The 55 gallon drum, wrapped in lead, will be set into a NC-90 shipping container. The shielded 55 gallon drum and NC-90 container will be filled with reactor grade water prior to the loading of end fittings. There are approximately 70 loose end fittings in the rubble and it is estimated that it will require approximately ten (10) 55 gallon/NC-90 containers to house them. A storage

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container will be located adjacent to the open slot on the Defueling Platform. Using an appropriate defueling tool, the fittings will be removed from the RV one at a time (or in a cluster if they adhere together), maneuvered to the container and released. A funnel/slide arrangement will assure that an end fitting will fall either into the container or back into the RV if it is dropped. This arrangement will also control possible contamination spread during the transfer of an end fitting from the RV to the container. Each drum will be uniquely identified as end fitting containers and will be limited to ten (10) end fittings including partial end fittings. During transfer of an end fitting or filled storage container, personnel will be removed from the immediate area as required by measured dose rates. The container will then be transferred to a location on the 347' elevation between the RV head service structure and the outer edge of the pressurizer "O" ring shield wall. The area will be identified as "for storage of upper end fitting containers only." Additional shielding of the area may be provided by using lead blankets or similar hanging shielding as necessary to lower dose rates in the area to appropriate levels.

Safety considerations relative to this proposal are:

1. Criticality potential
2. Radiation exposures and ALARA during movement and final storage of containers.
3. Potential container leakage.
4. Load movement and rigging.
5. Hydrogen generation.

Each of these concerns has been considered in the following manner:

1. Criticality - It has been estimated that each end fitting could contain approximately 2 or 3 kg of fuel if it were packed solidly within the flow spaces in the end fitting casting. End fittings will be examined to ensure fuel debris is not fixed or clinging to the surface such that the fuel content does not substantially exceed the estimated quantities. A maximum of ten (10) end fittings in a container will represent a potential fuel loading of 20 to 30 kg. This is significantly less than the minimum 70 kg of 3% enriched fuel required for a possible criticality under any condition. The end fittings will be submerged in a minimum 4350 ppm borated water. Both the 55 gallon drum and NC-90 containers will be closed with a lid to prevent inadvertent dilution of the borated water. Therefore, criticality in a single drum is precluded under any condition.

   The potential for criticality of approximately ten (10) containers has been evaluated. As stated previously, the fuel is submerged in water with a minimum of 4350 ppm boron. Reference 1 has shown this condition to be critically safe for any conceivable configuration or array. Reference 2 examined the possibility for criticality of the vessel and defueling canisters under draindown conditions and concluded that the TMI-2 core material would not become critical due

to the lack of moderator. Therefore, should one of the double walled containers undergo leakage and expose the end fittings, a criticality would not occur.

No other storage area that may contain more than 70 kg of fuel will be permitted to be established within 12 feet of this storage area. The containers will be treated as Special Nuclear Material and will be handled in accordance with approved plant procedures. Since ten such containers stored in one place constitutes a potential accumulation of approximately 4200 to 6300 grams of fissile material based on 3% enrichment; GPU Nuclear is installing suitable criticality monitors in the vicinity of the storage area in accordance with 10 CFR 70.24. A Recovery Operations Plan Change Request is being submitted to support installation of these monitors.

Based on the use of minimum 4350 ppm borated water, doubled-walled containers, including covers, storage in a restricted access area and limiting demineralized water sources in the immediate area of storage, monitoring of the boron content of the containers is not planned after initial fill.

2. Radiation exposure and ALARA - It has been calculated that each end fitting storage container will produce a maximum radiation level of 2 R/hr at 1 foot from the shielded container. The storage area will be roped off to prevent inadvertent access and shielding may be used to lower dose rates. Based on the maximum expected radiation levels, it is estimated that the exposure received in transferring the end fittings will be between 10 and 20 person rem for the entire operation.

3. Container leakage - The 55 gallon drum housing the end fittings is a metal container subject to corrosion. To prevent leakage, it has been inserted into a NC-90 shipping container. Leakage through this container is highly unlikely since it is constructed of fiberglass and is designed to contain contaminated water.

4. Load movement and rigging - Each storage container weighs approximately 3000 pounds when loaded. The storage container will be positioned in a lifting rig on the defueling platform. The lifting rig will be load tested to 200% of the loaded weight. Restrictions on lifting this weight will be observed. When the container has been filled, it will be lifted out of the protective lead shield on the platform, moved to the 347' elevation and positioned near the reactor head storage area. Once the container is properly located, the crane will be remotely decoupled from the container and moved back to the defueling platform for the next container.

In the unlikely event of a loaded storage container being dropped onto the Reactor Building floor, it is expected that the container will be damaged and its contents will spill onto the floor. Since

each storage container has a maximum of 30 kg of fuel, criticality is not a concern as the fuel available for spillage is less than the 70 kg required for a criticality event. Pyrophoricity concerns and releases due to a dropped storage container are bounded by the analysis performed for a dropped fuel canister in the Defueling Safety Evaluation Report (SER) (Reference 1).

During the period that the containers are being stored, the potential for a heavy load drop onto the containers exists. In the event of a heavy load drop into the storage area, it is assumed that all the storage containers in the area at the time of the drop are destroyed. As mentioned previously, 70 end fittings, each containing 2 kg to 3 kg of fuel, will be stored in the containers. Thus, on a worst case basis, there is the potential for 210 kg of fuel to be liberated if all containers are destroyed. This 210 kg fuel poses a criticality potential. However, this potential appears to be sufficiently small as to be considered non-existent based on the following:

- o Fuel on the floor with 4350 ppm borated water would be subcritical.
- o Fuel on a dry floor (i.e., no moderator) would be subcritical.
- o Fuel mixed with unborated water could become critical, but it does not appear possible to contain unborated water at sufficient depth on the 347' el. of the Reactor Building to permit this to occur.
- o Fuel in the end fittings is assumed to be within the flow space of the end fittings. Attempts will be made to remove this fuel from the flow space prior to transfer to the storage container. It is unlikely that the fuel remaining in the flow space would be dislodged by a heavy load drop. The fuel in the end fittings flow space is subcritical in any type of water.

GPU Nuclear considers a criticality due to the release of fuel from all containers as a result of a heavy load drop to be an unlikely event. Releases due to a heavy load drop onto the storage containers are bounded by the analysis performed for a dropped fuel canister in the Defueling SER.

5. Hydrogen generation - Assuming each container houses 20 to 30 kg of fuel, the maximum calculated hydrogen generation rate due to this fuel would be less than four (4) liters of hydrogen per year. Release of this small quantity to the reactor building does not appear to represent an explosive concern; however, to preclude pressurization of the container, the container covers will be vented.

Based on the above evaluation, it has been concluded that the proposed activity does not constitute an unreviewed safety question since it does not increase the probability or consequences of an accident previously evaluated, create the possibility of an accident of a different type than previously evaluated, or reduce the margin of safety as defined in any Technical Specifications.

Therefore, the proposed activity can be performed without undue risk to the health and safety of the public.

Sincerely,

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

FRS/RBS/eml

ATTACHMENT
4410-86-L-0132

REFERENCES

1. Defueling Safety Evaluation Report Revision 10, GPU Nuclear letter 4410-86-L-0049 dated May 15, 1986, from F. R. Standerfer to W. D. Travers

2. Seismic Design Criteria Safety Evaluation Report, GPU Nuclear letter 4410-85-L-0077 dated April 16, 1985, from F. R. Standerfer to B. J. Snyder