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
Use of Hydraulic Shredder

The purpose of this letter is to advise you of GPU Nuclear's proposal to utilize a hydraulically powered shredder to reduce the size of core debris and facilitate the loading of fuel canisters or debris buckets. The use of a shredder is not described in the currently approved revision of the Early Defueling Safety Evaluation Report (SER) (Reference 1). Therefore, it is not within the currently approved scope of defueling. This letter is intended to document that the installation and use of the shredder are bounded by previous submittals and can proceed safely.

The purpose of a shredder is to reduce fuel pins (with and without fuel) and Inconel spacer grids to sizes which will facilitate placement in fuel canisters or debris buckets. The shredder will be suspended below the defueling work platform using a support structure attached to the defueling work platform (DWP). The shredder is hydraulically powered using a working fluid borated to at least 4350 ppm. The shredder hydraulic system has a capacity of approximately 130 gallons and is independent of the existing hydraulic system used to power the other defueling tools. The control console will be located on the DWP and the shredder will be located in the reactor vessel close to the rubble bed. As planned, the fuel/debris will be loaded into an inlet hopper and the shredder output will be discharged to a transfer container which is then emptied into a fuel canister or debris bucket. Discharge from the shredder may also be directed to the debris bed.

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Nonshreddable material lodged in the shredder will be retrievable through manual manipulations using long-handled tools.

Safety concerns associated with the installation and use of the shredder have been identified and are evaluated below.

Structural Support Failure and Load Handling Accidents

The installation of the shredder will necessitate the movement of loads over the reactor vessel/IIF. These loads would include a number of DWP plates (to gain greater access into the reactor vessel), the shredder, its support structure, and its mounting carriage. All movements of loads in the Reactor Building and over the Reactor Vessel will be in accordance with the guidelines given in References 2 and 3. Adherence to those guidelines will ensure that the potential for a load drop is minimized and that the consequences of any postulated load drop are within the bounds of the aforementioned references which are NRC approved.

A postulated failure of the shredder support structure during operation would result in an impact loading of approximately 7300 lbs onto the debris bed. The projected loading is based on the following estimates:

Shredder and motor - 3800 lbs
Support structures and auxiliary components - 2200 lbs
Core debris in shredder and transfer container - 1300 lbs

The impact energy onto the rubble bed is a function of the distance from the bottom of the shredder to the rubble bed and the weight of the dropped components. During initial operation, the shredder would be close to the surface of the rubble (less than four feet) but the distance would increase as core debris material is removed. Additional sections of the support columns are available to lower the shredder in four (4) foot increments to minimize the distance from the shredder to the rubble. Thus, the furthest distance from the shredder to the rubble is expected to be approximately eight (8) feet. The maximum number of support structures are included in the weight estimates above. Any postulated failure of the support structures is bounded by the following evaluations performed for loading accidents.

The most significant time for a load drop to occur is during installation and removal of the shredder. During lifting operations over the Reactor Vessel, efforts will be made to minimize the potential for drops into the vessel that may affect the integrity of the Reactor Vessel Incore Nozzles. The lifting rig for the shredder has been designed with a capacity of approximately 7000 pounds which is greater than the estimated weight of the shredder, motor, inlet and outlet chutes, and supports. (Note: The shredder will not contain significant quantities of core debris nor will the debris container be attached during installation or removal.) The 7000 pound design weight includes a 1.15 dynamic load factor. Using a detailed finite element analysis, it was determined that the lifting rig has safety factors of greater

than 3 and 5 to yield and ultimate respectively. The lifting rig has been load tested to 200% capacity followed by a NDE of the structural welds. This is in agreement with the NUREG-0612 requirements for special lifting and handling devices. The shredder will be installed using either the Reactor Building Service Crane or the Polar Crane Auxiliary Hook. The relevant UWI will include an approved rigging diagram. Either crane has adequate rated capacity to install the shredder. Thus, a load drop during installation is considered unlikely.

Potential loadings directly onto the Reactor Vessel and supports as a result of a load drop are bounded by Reference 3 providing the bottom of the shredder remains at or below the 333 ft. elevation during transfer. If the impact is transmitted directly onto the debris bed, the limiting consequence is the failure of incore nozzle welds. This event has also been evaluated in Reference 3. Thus, potential structural failures or load handling accidents are bounded by previously approved evaluations.

Criticality

The TMI-2 core is maintained subcritical by ensuring against both a boron dilution event which could lower the boron concentration below 4350 ppm and a localized deboration within the core. The shredder is hydraulically powered using a working fluid which will be borated to at least 4350 ppm to preclude the introduction of fluid which could result in a boron dilution. The shredder also contains a quantity of unborated lubricating oil within the gear housing. This quantity of oil will be limited to two (2) gallons, consistent with the guidelines of Reference 4, to preclude a localized deboration event.

Pyrophoricity

The use of the shredder will generate heat and potentially create new unoxidized surfaces of reactive material, during the sizing of fuel rods, ranging in size from large pieces to fines. Reference 1 has shown that it is not possible to sustain a pyrophoric reaction and Reference 5 further noted that a sustained pyrophoric reaction resulting from the generation of fines within the reactor vessel is highly unlikely.

Operator Radiological Exposure

The shredder will be operated close to the rubble bed and a significant portion of the generated particulate matter is assumed to settle to the rubble bed. Therefore, shredder operations should not substantially increase the dose contribution from particulates in the Reactor Vessel water. The distance between the operators and the shredder combined with the amount of shielding afforded by the water and the DWP will minimize the dose contribution from shredder operation. Airborne releases of radioactivity to the Reactor Building are not expected to increase from shredder operation because of the "scrubbing" action of the Reactor Vessel water.

The operation of the shredder has the potential to increase the dissolved radionuclide concentration in the Reactor Vessel water and could increase the radiation levels to the operators. In the event that the shredder operation produces a higher concentration of radionuclides than has been experienced to date, water processing could be undertaken to lower the activity in the water. Currently, the Radiological Controls Department monitors dose rates on the platform to assure that dose rates to the operators are acceptable. The Radiation Controls Department will continue monitoring shredder operations and provide guidance for RCS processing and continued shredder operation to ensure doses to operators are within an acceptable range.

10 CFR 50.59 Evaluation

The installation and operation of the hydraulic shredder has been reviewed to determine if the proposed operation involved an unreviewed safety question. The installation and operation of the proposed hydraulic shredder has been shown to be bounded by previously approved Safety Evaluation Reports. Since the operation is bounded by previously approved activities which were determined not to involve an unreviewed safety question, the proposed activity does not constitute an unreviewed safety question.

In conclusion, GPU Nuclear has evaluated the planned handling and operation of the shredder with respect to plant and worker safety and has shown that the consequences of planned activities and postulated accidents are bounded by previously approved evaluations and do not involve an unreviewed safety question. GPU Nuclear, therefore, requests NRC concurrence to proceed with this activity. Reference 1 will be updated in the future to include the use of the shredder.

Sincerely,

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

FRS/RES/eml

Attachment

REFERENCES

1. Safety Evaluation Report for Early Defueling the TMI-2 Reactor Vessel, Revision 4, GPU Nuclear letter 4410-85-L-0200, dated October 10, 1985, from F. R. Standerfer to B. J. Snyder

2. Safety Evaluation Report for Heavy Load Handling Inside Containment, Revision 2, GPU Nuclear letter 4410-85-L-0172, dated September 11, 1985, from F. R. Standerfer to B. J. Snyder

3. Safety Evaluation Report for Heavy Load Handling Over the TMI-2 Reactor Vessel, Revision 0, GPU Nuclear letter 4410-85-L-0089, dated April 19, 1985, from F. R. Standerfer to B. J. Snyder

4. Report on Foreign Materials Allowed in the TMI-2 Reactor Coolant During Defueling Activities, GPU Nuclear memorandum 4410-85-M-0783, dated October 1, 1985, from J. J. Byrne to W. D. Travers

5. Responses to NRC Comments on the Defueling Canister Technical Evaluation Report, GPU Nuclear letter 4410-85-L-0167, dated August 15, 1985, from F. R. Standerfer for B. J. Snyder