GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057-0191
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:
(717) 948-8461

4410-86-L-0066
Document ID 0421A

April 17, 1986

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 Vessel Water Cleanup System

The purpose of this letter is to provide information concerning a proposal to install a new system to cleanup the Reactor Vessel (RV) water. The system will consist of two subsystems: one subsystem will destroy the organisms currently residing in the RCS utilizing high pressure as the kill mechanism and the second subsystem (the Temporary Reactor Vessel Filtration System (TRVFS)) will filter organic material from the Reactor Coolant System (RCS) using diatomaceous earth as a filter media. Operation of the TRVFS is described in Reference 1.

The Reactor Vessel Water Cleanup System (RVWCS) will consist of a portion of the Defueling Water Cleanup System (DWCS), the TRVFS and a high pressure (HP) pump. The DWCS will be used to supply the HP pump with a water supply for operation as well as providing a mixing action in the RV. The DWCS will be operated in the bypass mode (i.e., by-passing the filter canisters and with the post-filter cartridge removed) to preclude filter clogging; thus, efficiency of the operation will be increased. The HP pump will draw approximately 20 gpm from the discharge of the DWCS. Onsite testing has demonstrated that the pump will operate at a discharge pressure of approximately 10,000 psig. Exposure to this high pressure environment and subsequent rapid depressurization has been demonstrated to be an effective mechanism to destroy a large percentage of the organisms passing through the

D009
1/0
w/ check
$150.00
#00022586

system. Initially, the discharge of the pump will be returned to the RV through a hydro-lance which will be used to remove the organic growth from the RV walls and internal components. Following RV cleanup, the HP pump discharge may be routed to the TRVFS.

Actual cleanup of the RCS water will be accomplished using the TRVFS. Operation of the TRVFS will be similar to the mode described in Reference 1 except that input to the TRVFS may be obtained from the discharge of the HP pump instead of the RV. Pressure reducers will be used to match the discharge pressure of the HP pump to the TRVFS operating pressure.

Operation of the RVWCS has been reviewed to identify potential safety concerns. The following safety concerns have been identified:

- o Boron Dilution
- o Criticality
- o Offsite Releases
- o Workers Exposures
- o Reactor Vessel Integrity

Operation of the DWCS portion of the RVWCS has been evaluated and approved previously via Reference 2. Water will be drawn from the RV at approximately 220 gpm as required by DWCS design. The majority of the water (i.e., approximately 180 gpm not required for operation of the HP pump) will be returned to the RV. The remainder will be used either for recirculation flow through the DWCS pump (approximately 20 gpm) or as a water supply for the HP pump (approximately 20 gpm). The DWCS will be operated during this proposed cleanup operation without a filter canister or a filter cartridge in the post filter. Operation in this mode will not affect the conclusions of Reference 2 with respect to the safety concerns identified above.

As stated in Reference 1, suction for the TRVFS may be obtained from as low as elevation 310' in the RV annulus. This is approximately 15 feet above the fuel debris observed in the lower head region. During normal operations in conjuction with the HP portion of the RVWCS, the TRVFS suction will be routed through one of the eight surveillance capsule access holes or vent valve access holes while the discharge of the hydro-lance is routed through a second hole. These hoses will be repositioned, as required, to facilitate cleaning of the CSA. The majority of the time, the hydro-lance operations will be sufficiently distant from the suction of the TRVFS to preclude significant fuel debris transport and pickup by the suction nozzle of the TRVFS. Further, most of the flushing operations will be performed on vertical surfaces where significant fuel accumulation is not expected. These conditions, coupled with limiting the depth of the hydro-lance in the annulus (NOTE: hydro-lance use in the area of the core debris will not be performed) gives assurance that fuel deposition in the TRVFS will not differ significantly from the conditions discussed in Reference 1. In any case, the presence of 4350 ppm of boron ensures any fuel deposited in the filter will remain subcritical. Prevention of the possibility of vessel drain will be effected by installing siphon breakers in the piping of the RVWCS suction lines at approximately the 325'6"

elevation or by limiting the suction depth to approximately 325'6". Discharge lines will incorporate siphon breakers or the discharge depth will be limited where practical.

The high pressure portion of the system will utilize a high pressure pump, lines, fittings and a hydro-lance. Currently, plans call for the use of HP pump with a discharge pressure of approximately 10,000 psig. During the initial stage of RV cleanup, the pump discharge will be routed to a hydro-lance. The hydro-lance will be used for cleanup of the RV walls and components. The lance and long handled tool extensions are designed with mechanical stops to prevent the hydro-lance from affecting the RV incore nozzles. The longest tool extension will limit tool reach to a depth approximating that of the bottom of the core formers. After the RV and components have been flushed, the pump discharge may be routed to the suction line of the TRVFS through the high pressure manifold and a pressure reducing orifice. After passage through the orifice, the system pressure will be compatible with the TRVFS. Additionally, the TRVFS is protected by an open line of sufficient size to relieve the pressure which is routed to the RV.

Specific concerns with the usage of the HP pump and hydro-lance include boron dilution, RV integrity, criticality, and worker safety. Boron dilution and criticality control are bounded by evaluations performed for operation of the DWCS and the TRVFS. The various operational modes for the DWCS have been evaluated for criticality control and boron dilution potential in References 2 and 3, respectively. The HP pump obtains its water supply directly from the output of the DWCS taking suction from a connection to the DWCS post-filter, and discharges either to the RV or the TRVFS. There are dedicated suction and discharge hose connections to the pump. In a addition, the isolation barriers used for DWCS system operation will remain in place when using the HP pump. Therefore, the use of the HP pump does not significantly increase the boron dilution potential.

Since the RVWCS operates with a high discharge pressure, Reactor Vessel integrity was examined. The discharge pressure of the pump is approximately 10,000 psig. Water at this pressure is discharged into the RV through a hydro-lance which is designed with a series of diametrically opposed discharge ports to preclude significant reaction forces. This nozzle can be used to clean accessible areas of the RV, core support assembly, internal indexing fixture, defueling tools and components, or other RV components. The fact that the cleaning will be performed under water will rapidly reduce the forces transmitted to the components and damage is not considered credible. However, any debris that may be relocated as a result of hydro-lance use will not alter the conclusions of the RCS Criticality Analysis (Reference 4). In order to assure the integrity of the incore nozzles, the tool has been designed with mechanical stops to prevent the lowering of the nozzle to a depth inside the annulus where incore nozzles damage could be effected. Therefore, RV integrity is not considered to be a safety concern.

To assure worker safety, the hoses and fitting on the discharge side of the pump have been designed to accommodate the expected high pressures. Rupture

of hoses and the resultant worker doses and offsite releases are bounded by Reference 1. Operating procedures will be reviewed by the Safety and Health Department to ensure industrial safety as described previously in Reference 5.

Control of dose rates during normal operations has been addressed in References 1 and 2 for the TRVFS and DWCS portions of this system, respectively. Dose contributions from the high pressure portion of the system will be monitored by the Radiological Controls Department. Shielding or administrative controls will be provided,as necessary, to reduce dose rates to acceptable levels. Potential offsite releases are bounded by References 1 and 2.

Based on the above discussions, GPU Nuclear has concluded that operation of the proposed RVWCS is bounded by previously approved Safety Evaluation Reports and can be operated safely and without undue risk to the health and safety of the public and/or workers.

Per the requirements of 10 CFR 170, an application fee of $150.00 is enclosed.

Sincerely,

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

FRS/RBS/eml

Attachment

Enclosed: GPU Nuclear Corp. Check No. 00022586

ATTACHMENT
4410-86-L-0066

REFERENCES

1. Temporary Reactor Vessel Filtration System, Revision 2, GPU Nuclear letter 4410-86-L-0063, dated April 14, 1986.

2. Defueling Water Cleanup System Technical Evaluation Report, Revision 9, 15737-2-G03-106, January 1986.

3. Hazards Analysis: Potential for Boron Dilution of Reactor Coolant System, Revision 2, September 1985.

4. RCS Criticality Analysis, Revision 0, 15737-2-N09-001, October 1984.

5. Reactor Building Decontamination and Dose Reduction Activities Safety Evaluation Report, GPU Nuclear letter 4410-86-L-0042, dated March 28, 1986.