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US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sirs:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Defueling Water Cleanup System Fuel Transfer Canal/Spent Fuel Pool
Cross-Connect to the Reactor Vessel Cleanup System

Attached for NRC review and approval is a safety analysis in support of a proposed modification to the Fuel Transfer Canal (FTC)/Spent Fuel Pool (SFP) Cleanup System portion of the Defueling Water Cleanup System (DWCS). This proposed modification will allow processing of the FTC/SFP water through the "B" train of the DWCS Reactor Vessel Cleanup System thereby eliminating the need to install additional body feed and coagulant equipment in the Fuel Handling Building.

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

Sincerely,

F. R. Standerfer
Director, TMI-2

FRS/RDW/eml

Attachment

Enclosure: GPU Nuclear Corp. Check No. 004826

cc: Regional Administrator, Region 1 - W. T. Russell
Director, TMI-2 Cleanup Project Directorate - Dr. W. D. Travers

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SAFETY ANALYSIS

SA # ADDENDUM TO DWCS TER

Rev. # 0

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TITLE

DEFUELING WATER CLEANUP SYSTEM FUEL TRANSFER CANAL/SPENT FUEL POOL CROSS-CONNECT TO THE REACTOR VESSEL CLEANUP SYSTEM

Originator M.D. Smith Date 5/19/87

CONCURRENCE

Lead Engineer/RTR R E Sheppard Date 5/20/87 SRG [signature] Date 21 May 87

Cognizant Eng. J.D. Podolski Date 5/19/87 Rad Con N/A Date

APPROVAL

Mgr. Eng. Section D.K. Beckman Date 5/20/87 Site Ops Director Adam Miller for W. Potts Date 5/21/87

Mgr. Recovery Projs. N/A Date

FORM 4000-ENG-7310.09-1 (5/83)

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DEFUELING WATER CLEANUP SYSTEM FUEL TRANSFER CANAL/SPENT FUEL POOL CROSS-CONNECT TO REACTOR VESSEL CLEANUP SYSTEM

1.0 PURPOSE AND SCOPE

This evaluation addresses the modification of the Fuel Transfer Canal (FTC)/ Spent Fuel Pool (SFP) Cleanup System portion of the Defueling Water Cleanup System (DWCS) to allow processing of the FTC/SFP water through the "B" train of the DWCS Reactor Vessel (RV) Cleanup System. The purpose of this modification is to provide a capability to effectively process the FTC/SFP water in a manner similar to that used for RV cleanup without the installation of additional body feed and coagulant equipment in the Fuel Handling Building (FHB). Additionally, the proposed modification authorizes the use of FTC/SFP filtered effluent as a water source for the body feed tank and as dilution water for the coagulant addition unit.

The DWCS Technical Evaluation Report (TER) currently defines the RV Cleanup System and the FTC/SFP Cleanup System as separate and distinct subsystems. This distinction was also recognized in the safety evaluation attached to NRC TMICPO letter NRC/TMI-85-055, "Defueling Water Cleanup System." Thus, the proposed modification is presently outside the scope of the NRC-approved DWCS TER in that it allows interface between the two (2) subsystems.

2.0 SYSTEM MODIFICATION

The proposed modification essentially relocates the process filters for the FTC/SFP portion of the DWCS to inside the Reactor Building (RB). This is accomplished via hose jumpers between the discharge of DWC-P-3A (Fuel Transfer Canal Pump) and the discharge of DWC-P-2B (Reactor Vessel Cleanup Pump). Water is pumped from the FTC through the "B" train of the DWCS RV filtration system, back to the FTC pump discharge piping through RB penetration R-524 using normal DWCS FTC Cleanup System piping. The return path to the SFP is established by disconnecting a filter inlet connection. Use of a disconnected filter inlet hose to return filtered effluent to the SFP, as opposed to the normal return path, provides better mixing of SFP water prior to return of the water through the transfer tubes to the DWC-P-3A suction lines. However, transfer of filter effluent to the FTC or through the ion exchangers is still possible by closing the disconnected canister inlet hose isolation valve and establishing the appropriate flowpath.

The DWCS is totally contained within areas that have controlled ventilation and area isolation capability. This limits the environmental impact of the system during normal system operations, shutdown, or postulated accident conditions.

3.0 FILTER MEDIA RUPTURE AND CRITICALITY PREVENTION

In the proposed modified configuration, RV filter canisters will be capable of processing both FTC and RV water. Also, the post-filter (F-8) is not normally utilized. If FTC water is being processed and returned to the SFP through a disconnected canister inlet via a RV filter canister and a filter media rupture occurs, the potential exists to transfer RV fuel fines from the ruptured media directly to the SFP if the RV filter canister has also processed Reactor Coolant System (RCS) since, in this configuration, the

post-filter (F-8) is not in service. However, this condition does not create a safety concern since the boron concentration in the FTC and SFP water is maintained between 4350 and 6000 ppm boron. This boron concentration ensures that any fuel fines will remain subcritical under all credible conditions.

Should the decision be made to process FTC/SFP water through the ion exchangers, the appropriate flowpath will be established and post-filter F-8 will be placed in-service. Failure of filter canister media would introduce fuel fines into the system which would be collected by the critically safe post-filter, which is criticality safe by-design; thus, the ion exchanger is protected.

4.0 LINE BREAK

During processing of FTC/SFP water in the proposed modified system configuration, no net change in FTC/SFP water levels will be observed since the FTC and SFP water communicate via the transfer tubes. If a rupture occurred in the FTC/SFP Cleanup System, the available FTC pump could deliver FTC/SFP water to the FHB or RB. This event would lower the water level in the canal and the pool. However, a level loss would be detected by redundant level indicating systems, one each for the FTC and SFP, which are provided with low level alarms in the Control Room. Upon receipt of either low level alarm, the system would be shutdown manually and the loss of water inventory would be investigated.

5.0 BORON DILUTION

The FTC/SFP Cleanup System and the RV Cleanup System are normally separated by double valve isolation. However, double valve isolation between these systems will not be possible at all times. For example, only single valve isolation will exist when the DWCS is concurrently processing FTC/SFP water in "B" train and RV water in the "A" train. In the proposed modified configuration, single valve isolation will be provided by DWC-V384 and DWC-V385. GPU Nuclear believes that single-valve isolation is acceptable based on the following:

- Boron dilution of the RCS in the proposed modified configuration would require a double failure of a non-borated water source or a water source borated to less than RCS grade and injection into the FTC/SFP system concurrent with leakage of system isolation valves. Procedures required to operate the proposed system will contain prestartup checklists to ensure that water sources connected to the FTC/SFP process piping which are borated to less than Technical Specifications limits for RCS grade water are isolated. Therefore, DWC-V384 and DWC-V385 will provide the first barrier to RV deboration. The second barrier will be provided by those valves which have been verified closed in the prestartup checklist. In either event, an increase in FTC/SFP or Internal Indexing Fixture (IIF) water level would be detected and the systems would be shutdown if a failure occurred.

- FTC/SFP processing is not intended to be a continuous process. The vast majority of the time only the RV Cleanup System will be in operation; the probability of a double system failure is small. One processing cycle is estimated to be one million gallons of water processed once per quarter; at 50 gpm this cycle can be completed in approximately 16 days.

- The safety evaluation attached to NRC Amendment of Order dated April 23, 1985, recognized that the required boron concentration in the RCS, FTC, and SFP would essentially eliminate the possibility of boron dilution in the event that the water inventories of the RCS, FTC and SFP communicated because of a leak or valve misalignment. Even if such a leak or valve misalignment occurred, boron dilution of the RCS is considered incredible since the Technical Specification required boron concentration of the FTC/SFP (i.e., 4350-6000 ppm) is the same as that for the RCS. Thus, criticality due to a boron dilution event is not a concern.

6.0 EFFECT ON BODY FEED AND COAGULANT ADDITION

In the proposed configuration, a filter media rupture during filling of the body feed tank or while providing dilution water to the coagulant addition unit could transfer fuel fines to either or both systems since the post-filter will be bypassed. This scenario does not create a safety concern since the body feed tank and the coagulant addition unit will contain RCS grade borated water (4350-6000 ppm). This ensures that the fuel will remain subcritical under all credible conditions. The introduction of coagulant in the coagulant addition unit mixing chamber would dilute the borated water in the mixing chamber. However, the mixing chamber diameter of 5 1/2 inches is less than the single parameter criticality safety limit of 9.6 inches for a fully water reflected infinite cylinder of optimally moderate TMI-2 fuel; thus, subcriticality is ensured. Additionally, the active polymer of the coagulant is melamine-formaldehyde which has been previously evaluated in GPU Nuclear letters 4410-86-L-0216 dated December 31, 1986, and 4410-87-L-0021 dated February 20, 1987, which demonstrated that the use of this active polymer has no adverse affect on RCS chemistry and criticality control. It should be noted that the coagulant to be used may be one of two different vendor products, but each vendor product has melamine-formaldehyde as its active polymer.

7.0 10 CFR 50.59 EVALUATION

It is concluded, based on the evaluations presented in this safety analysis, that the proposed modification to the DWCS RV Cleanup System and the FTC/SFP Cleanup System may be implemented without undue risk and exposure to the operating personnel nor will it present undue risk to the health and safety of the public.

10 CFR 50, Paragraph 50.59, permits the holder of an operating license to make changes to the facility or perform a test or experiment, provided the change, test, or experiment is determined not to be an unreviewed safety question and does not involve a modification to the plant Technical Specifications.

A proposed change involves an unreviewed safety question if:

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased; or

b. The possibility for an accident or malfunction of a different type than any evaluated previously in a safety analysis report may be created; or

c. The margin of safety, as defined in the basis for any Technical Specifications, is reduced.

The several credible events have been analyzed in this safety analysis (i.e., filter media rupture and criticality prevention; reduced water level in either the FTC or SFP; and RCS deboration). These events are bounded by similar events described in the DWCS TER.

A filter media rupture has the potential to transport fuel fines to the FTC/SFP water via interactions with RV filter canisters which have processed RCS grade water. In the modified configuration with the post-filter (F-8) out of service, this scenario will not create a safety concern since the FTC/SFP contains RCS grade borated water which will ensure that the FTC/SFP remains subcritical under all credible conditions. With the post-filter in service, this scenario is similar to Section 3.2.1.3 and 3.2.2.3, "Filter Media Rupture," of Revision 9 to the DWCS TER. Therefore, it can be concluded that the analysis in the referenced DWCS TER sections still bounds this scenario.

The potential for transferring fuel fines, following a filter media rupture, to the body feed tank or the coagulant addition unit has been evaluated and shown to present no criticality concern since the water in these systems is RCS grade borated water. The fuel fines which could be transported to the coagulant addition unit mixing chamber would also remain subcritical due to its criticality safe geometry.

A line break in the FTC/SFP is bounded by the evaluation in Section 3.2.2.4, "Line Break," in the DWCS TER. Specifically, as addressed in the referenced section, a loss of water level in either the FTC or SFP would be detected and alarmed by redundant level indicating systems, one each for the FTC and SFP.

Even though single valve isolation will occasionally exist between the FTC/SFP Cleanup System and RV Cleanup System in the proposed configuration, the administrative and physical controls listed in Section 5 of this report significantly reduce the potential for a boron dilution event. Furthermore, the NRC Amendment of Order dated April 23, 1985, recognized that maintenance of the required boron concentration in the RCS, FTC, and SFP essentially eliminates the potential for boron dilution in the event that these water sources communicate due to a leak or valve misalignment.

Subcriticality is ensured by establishing the boron concentration at greater than 4350 ppm during the defueling process and ensuring that this concentration is maintained by monitoring the boron concentration and inventory levels and by isolating potential deboration pathways. Subcriticality in the filter system is maintained primarily by ensuring contact with borated water. Additionally, subcriticality is also maintained by the canister engineered safeguards and the design of the system piping. The active polymer, melamine-formaldehyde, of the coagulant of choice has been evaluated previously and shown not to adversely impact RCS chemistry nor criticality control.

Based on the above analysis, GPU Nuclear concludes that the proposed change does not increase the probability of occurrence or consequences of accident or malfunction of equipment important to safety previously addressed in NRC-approved safety evaluation. Similarly, GPU Nuclear has concluded that the proposed change does not create the possibility for an accident or malfunction of a different type than any addressed in a previous NRC-approved safety evaluation.

Technical Specification safety margins at TMI-2 are concerned with criticality control and prevention of further core damage due to overheating. As demonstrated by this safety analysis, Technical Specification safety margins will be maintained throughout the filtering process. Thus, the proposed change does not reduce the margin of safety as defined in the basis for any Technical Specifications.

Based on the above analysis, GPU Nuclear concludes that the proposed modified configuration to the DWCS RV Filtration System and FTC/SFP Cleanup System does not constitute an unreviewed safety question as defined by 10 CFR 50.59.