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10 CFR 50.90

TMI-15-071

July 23, 2015

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: License Amendment Request –Temporary Restoration of Borated Water Storage Tank Cleanup and Recirculation Operation

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (Exelon) requests the following amendment to the Technical Specifications, Appendix A, of Renewed Facility Operating License No. DPR-50 for Three Mile Island Nuclear Station, Unit 1 (TMI).

The proposed amendment would modify Technical Specification (TS) 3.3.1.1, Injection Systems, by the addition of two Notes to allow for the temporary operation of the Borated Water Storage Tank (BWST) connected to seismic Class II piping cleanup and recirculation paths to support activities associated with the TMI Fall 2015 Refueling Outage and Fuel Cycle 21 operation.

Attachment 1 provides the Evaluation of Proposed Changes. Attachment 2 provides the Proposed Technical Specification Marked-Up Page. Attachment 3 provides Flow Diagrams for BWST Cleanup Operation. Attachment 4 provides a Technical Evaluation to Assess BWST Cleanup Path Pipe Stress. Attachment 5 contains Proposed Mark-Up Procedure OP-TM-212-501, "Cleanup of the BWST." Attachment 6 contains Proposed Mark-Up Procedure OP-TM-AOP-003, "Earthquake." Attachment 7 contains Proposed Mark-Up Procedure OP-TM-AOP-0031, "Earthquake Basis Document." Attachment 8 provides the proposed Technical Specification Bases Marked-Up Page (for information only). Attachment 9 contains Procedure OP-TM-212-252, "Recirculation and Sampling of BWST (DH-T-1)."

The proposed changes have been reviewed by the TMI Plant Operations Review Committee and approved in accordance with Nuclear Safety Review Board procedures.

Exelon requests approval of the proposed amendment by September 25, 2015, in order to support necessary pre-outage clean-up activities for the TMI Fall 2015 Refueling Outage

which is scheduled to start October 29, 2015. Once approved, the amendment shall be implemented immediately.

There are no regulatory commitments contained in this submittal.

Using the standards in 10 CFR 50.92, "Issuance of amendment," Exelon has concluded that this proposed change does not constitute a significant hazards consideration as described in the enclosed analysis performed in accordance with 10 CFR 50.91(a)(1).

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," Exelon is notifying the Commonwealth of Pennsylvania of this application for changes to the TS by transmitting a copy of this letter and its attachments to the designated state official.

Should you have any questions concerning this submittal, please contact Frank Mascitelli at (610) 765-5512.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 23rd day of July 2015.

Respectfully,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachments:
1) Evaluation of Proposed Technical Specification Changes
2) Proposed Technical Specification Marked-Up Page
3) Flow Diagrams for BWST Cleanup Operation
4) Technical Evaluation to Assess BWST Cleanup Path Pipe Stress
5) Procedure OP-TM-212-501, "Cleanup of the BWST"
6) Proposed Mark-Up Procedure OP-TM-AOP-003, "Earthquake"
7) Proposed Mark-Up Procedure OP-TM-AOP-0031, "Earthquake Basis Document"
8) Proposed Technical Specification Bases Marked-Up Page (for information only)
9) Procedure OP-TM-212-252, "Recirculation and Sampling of BWST (DH-T-1)"

cc: USNRC Regional Administrator, Region I
USNRC Project Manager, TMI
USNRC Senior Resident Inspector TMI
Director, Bureau of Radiation Protection - PA Department of Environmental Resources

| | | |
|---|---|---|
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**ATTACHMENT 1**

EVALUATION OF PROPOSED TECHNICAL SPECIFICATION CHANGES

SUBJECT: License Amendment Request – Temporary Restoration of the Borated Water Storage Tank (BWST) Cleanup and Recirculation Operation

CONTENTS

License Amendment Request – Temporary Restoration of
Borated Water Storage Tank (BWST) Cleanup and Recirculation Operation

## 1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Renewed Facility Operating License No. DPR-50 for Three Mile Island Nuclear Station, Unit 1 (TMI).

Exelon Generation Company, LLC (Exelon) requests NRC approval for temporary operations to clean up the water in the BWST and perform weekly boron surveillance tests while questions about the adequacy of the seismic design of the cleanup and recirculation piping paths are being resolved under a Technical Interface Agreement, TIA 2015-01, "Request for Technical Assistance Regarding Three Mile Island Licensing Bases and Acceptability to Use a Non-Seismic Qualified Cleanup Path for the Borated Water Storage Tank" (Reference 1). This License Amendment Request (LAR) is required to support the pre and post Fall 2015 Refueling Outage activities and Fuel Cycle 21 operation. The BWST water inventory is used as a clean source of borated water to support fuel transfer activities. The request is a temporary proposal to allow sufficient time for Exelon to identify the most optimal approach to permanently resolve the issue. Depending upon the outcome of the TIA 2015-01, several options are currently being evaluated with the intent to resolve the issue by the end of the temporary period requested (start of Fuel Cycle 22 operation).

Specifically, Exelon proposes to perform BWST cleanup using the same method that has been used historically at TMI, for a total duration of not more than 720 hours (30 days) prior to the scheduled start of the TMI Fall 2015 Refueling Outage and for a total duration of not more than 1440 hours (60 days) during Fuel Cycle 21 operation.

In addition, Exelon proposes to use the BWST recirculation path for the performance of the weekly (and after each makeup) BWST boron concentration surveillance testing required by TS Table 4.1-3 Item 2. Currently, the weekly test involves entering a 72-hour Limiting Condition for Operation (LCO) action to use one of the Emergency Core Cooling System (ECCS) pumps to provide adequate BWST recirculation for boron sampling. This ECCS sampling path is a work around to avoid using the previous sampling path that involved seismic Class II piping. Using the BWST recirculation path for surveillance testing is expected to take approximately 30 hours per week.

The justification for temporary restoration of the BWST Cleanup and Recirculation operation is based on additional design and administrative controls. A seismic evaluation has been performed that concluded the Cleanup and Recirculation seismic Class II piping paths would maintain pressure boundary integrity during a Safe Shutdown Earthquake (SSE). The seismic Class I BWST would maintain its safety functions during an SSE. In addition, administrative controls using proceduralized operator manual action provide additional defense-in-depth actions during a seismic event.

Exelon requests approval of the proposed amendment by September 25, 2015, in order to support necessary pre-outage clean-up activities for the TMI Fall 2015 Refueling Outage. Once approved, the amendment shall be implemented immediately.

## 2.0 DETAILED DESCRIPTION

Technical Specification (TS) Change

TS 3.3.1 states:

"3.3.1 The reactor shall not be made critical unless the following conditions are met:

3.3.1.1 Injection Systems

a. The borated water storage tank (BWST) shall contain a minimum of 350,000 gallons of water having a minimum concentration of 2,500 ppm boron at a temperature not less than 40°F. If the boron concentration or water temperature is not within limits, restore the BWST to OPERABLE within 8 hrs. If the BWST volume is not within limits, restore the BWST to OPERABLE within one hour. Specification 3.0.1 applies."

The proposed change will revise Technical Specification (TS) 3.3.1.1, "Injection Systems," by adding the following Note to TS 3.3.1.1.a. for the BWST:

NOTE:

1. The BWST piping may be unisolated from seismic Class II Cleanup path piping for a total duration of not more than 720 hours prior to the scheduled start of the Fall 2015 Refueling Outage and for a total duration of not more than 1440 hours during the following Fuel Cycle 21 operation under administrative and design controls for filtration and/or demineralization of the tank contents.

2. The BWST piping may be unisolated from seismic Class II Recirculation path piping to perform weekly (and after each makeup) BWST boron concentration surveillance testing until the end of Fuel Cycle 21 operation.

TS Bases Change (for NRC information only)

The BWST can be placed on cleanup path, or recirculation path for weekly surveillance testing for boron concentration, on a temporary basis, until the end of the Fuel Cycle 21 operation. A seismic evaluation has been performed that concluded the cleanup and recirculation seismic Class II piping paths would maintain pressure boundary integrity during a Safe Shutdown Earthquake (SSE). The seismic Class I BWST would maintain its safety functions during an SSE. The limiting condition for operation (LCO) for BWST cleanup operation is a total duration of not more than 720 hours (30 days) prior to Fall 2015 Refueling Outage and is a total duration of not more than 1440 hours (60 days) during Fuel Cycle 21 operation. BWST Cleanup can be started and stopped at any time as long as the total durations are not exceeded. The LCO for BWST Recirculation operation is limited to the time it takes to adequately recirculate the BWST volume to perform the boron sampling surveillance, which is approximately 30 hours per week. The temporary LCOs are in effect to allow time for a permanent solution to the issue of interconnecting seismic Class I and II piping during BWST Cleanup and Recirculation operation.

BWST Cleanup Operation Background

The BWST contains greater than 350,000 gallons of water with a boron concentration above 2500 ppm. The BWST has design functions to provide the source for High Pressure Injection (HPI), Low Pressure Injection (LPI) and Reactor Building Spray (BS) systems, to provide an emergency boration water source, to provide the water volume to fill the refueling transfer canal and to provide reactor coolant system makeup water during cooldown.

Historically, TMI was periodically using its Spent Fuel Pool (SF) and Liquid Waste Disposal (WDL) systems to filter and demineralize the BWST water while in plant conditions and modes for which the BWST was required to be operable. See Attachment 3 for simplified flow diagrams of the BWST connected to the SF and WDL systems for filtration/demineralization. It was believed that this system alignment could render the BWST inoperable during a seismic event since WDL piping, filters, and demineralizers are not seismically-qualified to seismic Class I. This was the original design of the plant; TMI was designed before 10CFR50 Appendix A, GDC 2, "Design bases for protection against natural phenomena," set a more conservative standard requiring additional seismically-designed piping at U.S. plants.

During resolution of GL 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46," TMI evaluated the BWST Cleanup alignment and concluded that there was seismic adequacy of the system configuration, using administrative procedure controls and operated in this manner until Information Notice (IN) 2012-01, "Seismic Consideration-Principally Issues Involving Tanks," was issued on January 26, 2012. Cleanup operation resumed after evaluation of IN 2012-01 and stopped after receiving a violation in May 2014 (Reference 2). Historically, isotopic concentrations in the BWST have fluctuated in accordance with outage activities, and subsequent to the NRC violation, they have risen and are currently approximately one thousand times normal concentrations.

There are current procedures to respond to seismic events at the TMI site which address BWST Cleanup operation. Marked-up TMI procedure OP-TM-AOP-003, "Earthquake," (Attachment 6) requires that the control room operators ensure that the BWST is isolated from Cleanup operation through the WDL system if a seismic event occurs. Marked-up TMI procedure OP-TM-AOP-0031, "Earthquake Basis Document," (Attachment 7) provides a list of design or licensing basis requirements and earthquake mitigating strategies including isolating BWST Cleanup during a seismic event.

TMI's BWST is normally maintained with greater than 350,000 gallons and with a boron concentration of greater than 2500 ppm Boron. These are TS requirements under T.S. 3.3.1.1. In addition, two BWST level instruments are required to be operable under T.S. 3.3.1.1. These two instruments, DH-LT-0808 and -0809, alarm if the BWST level increases to greater than 57.5 feet or decreases to less than 56.2 feet. These instruments would provide indication to the Control Room operators if a failure of a seismic Class II WDL system component resulted in a loss of BWST inventory.

The EPRI *Pressurized Water Reactor Primary Water Chemistry Guidelines*, in Appendix B.6, describe the requirements for plants to maintain their BWST chemistries, and also describes experience at plants where BWST water adversely affected plant operations. TMI has committed to comply with these EPRI Guidelines (for example, as conditions of its License Renewal Process and Steam Generator Program). TMI Procedure, CY-AP-120-170, "Refueling Water Storage Tank, Borated Water Storage Tank, Safety Injection Refueling Water Tank,"

describes the current chemistry analyses, limits, and analysis frequencies for water in the BWST.

The BWST is cleaned periodically for a number of reasons. While the plant operates, the BWST is required to be operable to maintain a borated water supply for accident mitigation purposes. Cleaning the contents of the tank minimizes the radiological dose rates to workers working near the tank. The contents of the BWST are used to flood the Fuel Transfer Canal during refueling outages. The BWST water during refueling outages is then intermingled with water from the Reactor Vessel, the Spent Fuel Pool, and the Fuel Transfer Canal. Cleaning the BWST contents prior to and post refueling outages helps to ensure that the optical clarity of the refueling water is maintained, and also minimizes the dose rates for workers in the area of the refueling water (i.e., above the Reactor Vessel, Fuel Transfer Canal, or Spent Fuel Pools). Based on the current isotopic level of Cobalt-58, and absent significant shielding modifications, if the BWST is not cleaned up, estimated dose to the refuel workers is between 3 Rem - 4 Rem compared to 1 Rem last outage. The dose impact to the Reactor Vessel 10-Year Inservice Inspection (ISI) workers is an additional 2 - 3 Rem. A lack of BWST cleanup will also add approximately 1 - 2 Rem of additional exposure to workers outside the Reactor Building in the yard area, while loading and unloading outage equipment.

BWST Cleanup and Recirculation Operation

Refer to Attachment 3, Flow Diagrams for BWST Cleanup and Recirculation operation, for the following discussion.

The BWST (shown on P&ID 302-640) is classified as a seismic Class I Engineered Safeguards System and serves as a source of emergency borated cooling water for HPI, LPI and BS systems. The BWST water inventory is normally used to fill the refueling transfer canal for refueling operations.

The WDL System (shown on P&ID 302-691) provides operating service functions to the reactor coolant system and spent fuel pools in addition to the collection, containment, and processing of miscellaneous wastes for reuse or disposal. The piping is designed to seismic Class II and is contained in a seismic Class I building.

In addition, interfacing seismic Class I piping of the SF system (shown on P&ID 302-630) is used to connect the BWST and WDL systems. The seismic Class I boundary manual valves, SF-V-40 (SF-P-2 Discharge Isolation Valve to LWDS System) and SF-V-43 (LWDS To Spent Fuel System Isolation Valve) can be used to isolate the seismic Class I and Class II systems.

When the BWST is aligned for Cleanup operation per procedure OP-TM-212-501 (Attachment 5) the water flows out of the BWST 8-inch line through the seismic Class I SF piping to the SF-P-2, Borated Water Recirculation Pump. SF-P-2 pumps the BWST water through seismic Class I boundary manual valve, SF-V-40, where the piping transitions to WDL seismic Class II 3-inch piping. Although several WDL cleanup configurations are possible, typically the BWST water is first routed through the WDL-F-1A, Precoat Filter, and then through the two Cation Demineralizers, WDL-K-2A and 2B. The filtered water is returned from the Demineralizers via 3-inch WDL piping through seismic Class I boundary manual valve, SF-V-43, to seismic Class I SF 4-inch piping back to the BWST.

When the BWST is aligned for Recirculation operation per OP-TM-212-252 (Attachment 9), it uses essentially the same path as cleanup as described above, except the Cation

Demineralizers are bypassed. After approximately 24 hours of recirculating the BWST water, the BWST weekly surveillance sample can be taken by opening DH-V-31 and DH-V-153.

The piping and components of the WDL systems used for BWST Cleanup and Recirculation operation have no accident mitigation purposes and accordingly are designed to seismic Class II requirements. The WDL system design complies with Regulatory Guide 1.143 requirements.

## 3.0 TECHNICAL EVALUATION

Piping and Piping Support Seismic Analysis

A technical evaluation (Attachment 4) was completed for the subject Seismic Class II piping in the WDL system used for the BWST Cleanup and Recirculation operation. Class II structures, components, and systems are important to reactor operation but not essential to safe shutdown and isolation of the reactor and whose failure could not result in the release of substantial amounts of radioactivity. Those structures, components, and systems, including instruments and controls, whose failure might cause or increase the severity of a loss of coolant accident or result in an uncontrolled release of radioactivity, and those structures and components which are vital to safe shutdown and isolation of the reactor are designated Class I.

The technical evaluation provided a seismic evaluation of the existing, as installed, WDL cleanup and recirculation piping, including pipe stress and pipe support structural capacity. It evaluated the current Seismic Class II (Operating Basis Earthquake (OBE)) piping and supports' response to Seismic Class I (Safe Shutdown Earthquake (SSE)) event. An SSE earthquake subjects the plant to accelerations twice that of an OBE. The piping system in question must withstand an SSE without loss of pressure boundary integrity. The technical evaluation was not intended to support a permanent design change. The technical evaluation provided the basis for reassurance to support the limited period time TS LCO (approximately September 2015 – September 2017). The seismic evaluation concluded that the seismic Class II piping would maintain pressure boundary integrity during an SSE.

The piping stress analysis concluded that the maximum piping stresses are below their respective allowables and are acceptable. The maximum seismic displacements are within the analysis boundary, and less than one inch, and are acceptable. The maximum valve accelerations of all subject valves are less than 1g and are acceptable. The equipment nozzle loads are within the analysis boundary and are acceptable. All pipe supports evaluated were determined to be structurally adequate for the applied loads.

In summary, the qualifications of all associated piping stresses, valve accelerations, pipe seismic displacements, equipment nozzle loads and pipe support loads, as documented in more detail in the attached technical evaluation, demonstrate that liquid radwaste piping (WDL) used for cleanup or recirculation of the BWST will withstand an SSE without loss of pressure boundary integrity. Should the site experience an SSE during BWST Cleanup or Recirculation operation, it is expected that there will be no leakage in the interconnected WDL system and piping, and the BWST will remain operable throughout the seismic event.

Defense in Depth-Isolating BWST Cleanup during a Seismic Event

As an additional defense-in-depth measure during an SSE or OBE seismic event, to support this temporary period of recirculation and cleanup of the BWST during on-line operation, current administrative actions through established procedures require the timely removal of the BWST

from Cleanup or Recirculation operation. Should a seismic event occur, during BWST Cleanup or Recirculation operation, the Control Room Supervisor will implement a step in OP-TM-AOP-003, directing the BWST be taken off of Cleanup or Recirculation operation, thereby isolating the BWST from seismic Class II piping. The proposed changes to the existing operation procedures provides additional assurance that the isolation of the BWST from the Class II piping is given very high priority among a list of operator actions immediately following ground motion felt by station personnel. The manual seismic Class I boundary valves SF-V-40, SF-V-43 will be closed and SF-P-2 pump will be secured, after ground motion is detected, and is not dependent on confirmation if an OBE or SSE level acceleration were reached. As an additional line of defense against boundary valve failures, double valve isolation is provided by also closing seismic Class I manual valves, SF-V-20 and SF-V-45, which are in series with the boundary isolation valves.

The use of defense-in-depth administrative actions would be limited to 720 hours of BWST Cleanup operation and approximately 150 hours of BWST Recirculation operation for Fuel Cycle 20 and 1440 hours of Cleanup operation and approximately 3000 hours of BWST Recirculation operation in Fuel Cycle 21.

An operating experience and precedence review for BWST Cleanup operation indicated that Farley and Indian Point Nuclear Stations (See Section 4.2, Precedent) used only administrative controls, via license amendments, for a limited period during on-line operation for cleanup of their Refuel Water Storage Tanks (RWST). No negative trends or significant operating events were identified.

Since removing the BWST from Cleanup or Recirculation operation are not new actions for TMI operators, functional requirement analysis and function allocation are not necessary. Prior experience has shown that operators, when assigned this task under non-transient daily plant operations that are not part of the AOP or EOP procedures, had sufficient time and resources available to perform it reliably for approximately 40 years. Staffing and operator qualification are not affected by the proposed LAR. No new or additional operators are required, nor are there any new or additional qualifications or training required to perform the action sequence required to isolate the BWST from Cleanup or Recirculation operation.

Conclusion:

A combination of interim design controls (interim seismic evaluation) and administrative controls (isolating BWST Cleanup or Recirculation operation during seismic event) ensures that interconnected seismic Class II WDL systems used during BWST Cleanup or Recirculation operation will not impact the operability and safety functions of the BWST during normal plant operation, should an OBE or SSE occur.

## 4.0 REGULATORY EVALUATION

### 4.1 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met. Exelon has determined that the proposed changes do not require any exemptions or relief from regulatory requirements. Note that TMI was designed and constructed taking into consideration the general design criteria for nuclear power plant construction permits as listed in the proposed AEC General Design Criteria, dated July 1967. The following current applicable regulations and regulatory requirements were reviewed in making this determination:

10 CFR 50, Appendix A, General Design Criteria

Criterion 2, "Design bases for protection against natural phenomena," requires *that structures, systems, and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without the loss of the capability to perform their safety functions.*

> TMI meets the following Atomic Energy Commission (AEC) GDC 2 - Performance Standards (Category A):
>
> *Those systems and components of Reactor Building facilities which are essential to the prevention of accidents, which could affect the public health and safety or to mitigation of their consequences shall be designed, fabricated, and erected to performance standards that will enable the facility to withstand, without loss of the capability to protect the public, the additional forces that might be imposed by natural phenomena such as earthquakes, tornados, flooding conditions, winds, ice, and other local site effects. The design bases so established shall reflect: (1) appropriate consideration of the most severe of these natural phenomena that have been recorded for the site and the surrounding area, and (2) an appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design.*
>
> Note that TMI is a USI A-46 plant and current licensing and design basis does not require the plant be designed for concurrent LOCA and SSE events.
>
> The filtration/demineralization of the seismic BWST will use the seismic piping meeting the AEC GDC 2 criterion but will also use the non-seismic WDL piping which does not meet the Appendix A GDC 2 criterion. Thirty days prior to the scheduled start of the Fall 2015 Refuel Outage, and for 60 days during the following Fuel Cycle 21, and for approximately 30 hours per weekly BWST boron surveillance testing, operation of BWST Cleanup and Recirculation paths will use interim compensatory design and administrative controls to assure operability of the BWST during an SSE.

Criterion 35, "Emergency core cooling," requires *a system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts. Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available)*

*and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.*

Under this proposed LAR, the BWST will maintain its operability during an SSE. The plant will continue to meet Criterion 35 by using proven procedures and design features in place for the past 40 years coupled with additional interim design analysis and administrative controls for BWST Cleanup or Recirculation isolation that will ensure the BWST maintains its safety related functions.

10CFR50.36(c)(2)(ii)(b) Criterion 3

Criterion 3 requires *a Limiting Condition for Operation (LCO) for a structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.*

The use of interim design controls and operator action to isolate the BWST to maintain seismic qualification and operability of the BWST while in Cleanup or Recirculation operation requires a limiting condition for operation. This LAR provides for a total time of 90 days of BWST Cleanup operation on-line to support pre 2015 Fall Refueling Outage activities and Fuel Cycle 21 operation. In addition, this LAR provides approximately 30 hours of BWST Recirculation operation per test to support the weekly BWST boron sampling surveillance requirement to the end of the Fuel Cycle 21 operation.

Relevant Guidance:

Regulatory Guide 1.143, "Design Guide for Radiological Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants"

The WDL design complies with RG 1.143, Rev 1, dated October 1979, requirements.

Generic Letter 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46," dated February 19, 1987

Information Notice (IN) 2012-01, "Seismic Considerations -Principally Issues Involving Tanks," dated January 26, 2012

NUREG-1764, "Guidance for the Review of Changes to Human Action," Rev 1

The U.S. Nuclear Regulatory Commission (NRC) reviews changes in human actions, such as those that are credited in nuclear power plant safety analyses. This document provides guidance for reviewing those changes. This LAR provides a qualitative assessment that addresses several applicable factors such as operating experience review, task analysis, staffing, and procedure design.

4.2 PRECEDENT

License Amendment No. 309 for TMI Amendment Re: Exigent Technical Specification Change Request No. 309, Nuclear Services River Water System (TAC NO. MB1187), dated February 23, 2001 (ML010570083).

This amendment allowed a one-time exception to the system configuration and maintenance requirements in Technical Specification (TS) 3.3.2 related to the nuclear service river water (NR) system at TMI, in order to allow a proposed up to 14-day repair of a leaking underground concrete pipe. The requirements of TS 3.3.1.4 to have two NR pumps OPERABLE were unchanged. During the 14-day repair period, the NR pumps' flows were realigned to pass through a portion of the non-seismic secondary services river water system.

License Amendment No. 250 for Indian Point Nuclear Generating Station Unit No. 3, Issuance of Amendment re: Connecting Non-seismic Purification System Piping to the Refueling Water Storage Tank (TAC No. ME9263), dated February 22, 2013 (ML13046A166)

This amendment revised TS 3.5.4, "Refueling Water Storage Tank," to permit non-seismically qualified piping of the Spent Fuel Pool purification system to be connected to the Refueling Water Storage Tank seismic piping under administrative controls for a limited period of time in order to purify the contents of the Refueling Water Storage Tank.

License Amendment Nos. 188 and 183 to Joseph M. Farley Nuclear Plant (FNP), Units 1 and 2, respectively, Issuance of Amendments Regarding Refueling Water Storage Tank (TAC NOS. ME8005 AND ME8006), dated March 24, 2012 (ML120730610)

These amendments revised the FNP TS 3.5.4, "Refueling Water Storage Tank," to permit the use of a seismically qualified boundary valve under administrative controls for limited periods of time.

4.3 NO SIGNIFICANT HAZARDS CONSIDERATION

Exelon has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The use of the Liquid Waste Disposal System (WDL) and the Spent Fuel Pool Cooling System (SF) to re-circulate and cleanup the BWST contents does not involve any changes or create any new interfaces with the reactor coolant system. Therefore, the connection of the WDL and SF to the BWST would not affect the probability of Large and Small Break Loss of Coolant Accidents occurring. The WDL and the applicable components of the SF are not credited for safe shutdown of the plant or accident mitigation. A technical evaluation was performed to validate the seismic adequacy of the WDL piping to withstand a Safe Shutdown Earthquake (SSE). The evaluation determined sufficient margin exists in the installed piping and supports such that during an SSE, the WDL system and piping would not lose pressure boundary integrity. In addition, as additional defense-in-depth measure, administrative controls ensure that the BWST can be isolated from seismic Class II WDL piping following an SSE. Since the BWST will continue to perform its safety functions and overall system performance is not affected, the consequences of an accident are not increased.

   Therefore, the proposed change does not involve a significant increase in the probability

or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The design of the BWST, WDL and SF systems to allow recirculation and filtration / demineralization has not been altered. No procedure changes are required to start or end BWST Cleanup or Recirculation operation. Since the seismic adequacy of the interconnected WDL system and piping has been evaluated for an SSE and validated by calculations to maintain pressure boundary integrity, the BWST safety functions are not affected.

   Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

   The WDL and applicable components of the SF are not credited for safe shutdown of the plant or accident mitigation. The seismic adequacy of the BWST is maintained. The seismic evaluation determined that sufficient margin exists in the installed piping and supports such that during an SSE, the seismic Class II WDL system and piping would not lose pressure boundary integrity. Maximum piping and piping support stresses are below their respective allowables, are acceptable, and no pipe leakage will occur.

   Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, Exelon concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of no significant hazards consideration is justified.

## 4.4 CONCLUSIONS

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

## 5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 6.0 REFERENCES

1. NRC Internal Memorandum from Michael L. Scott, Deputy Director, Division of Reactor Projects – Division I to Mirela Gavrilas, Deputy Director, Division of Policy and Rulemaking, NRR, "Request for Technical Assistance Regarding Three Mile Island Licensing Bases and Acceptability to Use a Non-Seismic Qualified Cleanup Path for the Borated Water Storage Tank (TIA 2015-01)," dated April 10, 2015

2. Three Mile Island Station, Unit 1 – NRC Integrated Inspection Report 5000289/2014002, dated May 14, 2014

**ATTACHMENT 2**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

**PROPOSED TECHNICAL SPECIFICATION MARKED-UP PAGE**

**Page 3-21**

NOTE:
1. The BWST piping may be unisolated from seismic Class II Cleanup path piping for a total duration of not more than 720 hours prior to the scheduled start of the Fall 2015 Refueling Outage and for a total duration of not more than 1440 hours during the following Fuel Cycle 21 operation under administrative and design controls for filtration and/or demineralization of the tank contents.
2. The BWST piping may be unisolated from seismic Class II Recirculation path piping to perform weekly (and after each makeup) BWST boron concentration surveillance testing until the end of Fuel Cycle 21 operation.

## 3.3 EMERGENCY CORE COOLING, REACTOR BUILDING EMERGENCY COOLING AND REACTOR BUILDING SPRAY SYSTEMS

Applicability

Applies to the operating status of the emergency core cooling, reactor building emergency cooling, and reactor building spray systems.

Objective

To define the conditions necessary to assure immediate availability of the emergency core cooling, reactor building emergency cooling and reactor building spray systems.

Specification

3.3.1 The reactor shall not be made critical unless the following conditions are met:

3.3.1.1 Injection Systems

a. The borated water storage tank (BWST) shall contain a minimum of 350,000 gallons of water having a minimum concentration of 2,500 ppm boron at a temperature not less than 40°F. If the boron concentration or water temperature is not within limits, restore the BWST to OPERABLE within 8 hrs. If the BWST volume is not within limits, restore the BWST to OPERABLE within one hour. Specification 3.0.1 applies.

b. Two Makeup and Purification (MU)/High Pressure Injection (HPI) pumps are OPERABLE in the engineered safeguards mode powered from independent essential buses. Specification 3.0.1 applies.

c. Two decay heat removal pumps are OPERABLE. Specification 3.0.1 applies.

d. Two decay heat removal coolers and their cooling water supplies are OPERABLE. (See Specification 3.3.1.4) Specification 3.0.1 applies.

e. Two BWST level instrument channels are OPERABLE.

f. The two reactor building sump isolation valves (DH-V-6A/B) shall be remote-manually OPERABLE. Specification 3.0.1 applies.

g. MU Tank (MUT) pressure and level shall be maintained within the Unrestricted Operating Region of Figure 3.3-1.

1) With MUT conditions outside of the Unrestricted Operating Region of Figure 3.3-1, restore MUT pressure and level to within the Unrestricted Operating Region within 72 hrs. Specification 3.0.1 applies.

2) Operation with MUT conditions within the Prohibited Region of Figure 3.3-1 is prohibited. Specification 3.0.1 applies.

3.3.1.2 Core Flooding System

a. Two core flooding tanks (CFTs) each containing 940 ± 30 $ft^3$ of borated water at 600 ± 25 psig shall be available. Specification 3.0.1 applies.

**ATTACHMENT 3**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

# FLOW DIAGRAMS FOR BWST CLEANUP OPERATION

| REVISIONS | | |
|---|---|---|
| REV | ZONE | DESCRIPTION |
| 84 | H-5,6 | REV. TO INCORPORATE AN ADMINISTRATIVE REV. PER AR 01334848. CHANGED LINE SPEC FLAG FROM "N" TO "M" AT COORDINATES H-5,6. |

## NOTES

1. VALVE POSITIONS SHOWN FOR REFERENCE ONLY. ACTUAL POSITIONS CONTROLLED BY PROCEDURES.
2. ALL INSTRUMENT TAG NUMBERS ARE PREFIXED BY SYSTEM DESIGNATOR UNLESS OTHERWISE NOTED.
3. SET POINT VALUES FOR RELIEF VALVES TO BE FOUND IN THE APPLICABLE ENGINEERING SET POINT DATA BASE
4. SYSTEM DESIGN BASIS – SEISMIC CLASS I
5. NO INSULATION REQUIRED WITHIN THE AUXILIARY BUILDING EXCEPT FOR PERSONNEL PROTECTION.
6. FOR DESIGN CONDITIONS AND B.& W. INSTRUMENTATION SEE B.& W. DWG. 27554F & DWG. 135756E.
7. SEE DRAWING 302-641 FOR PUMP CONNECTIONS AND AND AUX. EQUIPMENT
8. DH-S-1A/B INTERNALS REMOVED.
9. TEST PLUGS ARE NOT INSTALLED DURING PLANT OPERATION.
10. DH-FE-231A/B ORIFICE IS NOT INSTALLED.
11. SEE DWG. 302279 SH.1 FOR INSTRUMENT AIR DETAILS TO VALVE OPERATOR.
12. DH-V27 IS BYPASSED BY AN OPEN 14" MANWAY VENT

| NO. | DWG. NO. | TITLE |
|---|---|---|
| | | REFERENCES |
| 3 | 302-003 | COMPONENT & SYS ID INDEX |
| 2 | 302-002 | SYMBOLS INSTRUMENTATION |
| 1 | 302-001 | SYMBOLS FLOW DIAGRAM |

Cad File Name : 302640_R84

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Exelon Nuclear

DRAWN: MARK TETKOSKIE 05/07/12
CHKD: 5/7/12
DESIGN MANAGER: N/A
ENGINEER: N/A
ENGINEERING MANAGER: 6/1/12
IN'TERFACING CONCURRENCE

# DECAY HEAT REMOVAL
## FLOW DIAGRAM

TMI-1 | DWG. NO. 302-640 | SH. | REV. 84 | SCALE: NONE | BA NO. –

DWG. NO. 302-640 SH.

| REVISIONS | | |
|---|---|---|
| REV | ZONE | DESCRIPTION |
| 32 | C,D-2 | REVISED TO INCORPORATE ECR-11-00371 REV. 0 |

SF-P-1A SPENT FUEL COOLANT PUMP

SF-P-1B SPENT FUEL COOLANT PUMP

SF-P-2 BORATED WATER RECIRC PUMP

SF-C-1A SPENT FUEL COOLER

SF-C-1B SPENT FUEL COOLER

SPENT FUEL POOL "A" 435,000 GAL

SPENT FUEL POOL "B" 215,000 GAL

SPENT FUEL CASK LOADING PIT 20,000 GAL ELEV 303'-6"

EAST SIDE (INLETS)

WEST SIDE (OUTLETS)

SIPHON BREAK 1/2" DIA HOLE

FUEL TRANSFER CANAL

FUEL TRANSFER TUBES

SOLENOID HOOK-UP FOR VALVES MARKED △ (12 PLACES)

TAGGED VALVE

FLANGE "O" RING TEST CONNECTIONS

REACTOR CAVITY FLOODING

RB SUMP

PEN. 304

SIGHT HOSE

ISO TEST DRAIN

ISO TEST (VENT)

QUICK DISCONNECT

COOLING WATER FOR CONTINUATION SEE DWG 302-610

FROM RECLAIMED WATER 302-669 (E-5)

FROM BORIC ACID PUMP 302-670 (D-3)

NON-NUCLEAR N-3 S-II

HOSE CONN FOR SAMPLE & DRAIN

TO BORATED WATER STORAGE TANK 302-640 (F-2)

SEE NOTE 3

TO DECAY HEAT PUMP "A" SUCTION & DH-V50 302-640 (B-6)

TO FD

FROM LWD CLEANUP 302-691 (F-7) OR RC BLEED TANK

3" TO LWD CLEANUP 302-691 (H-8)

PRIMING CONNECTION

TO OR FROM BORATED WATER STORAGE TANK VIA DECAY HEAT SYSTEM RECIRCULATION AND TEST LINE 302-640 (F-2)

SEE SOLENOID HOOK-UP

(4" THIS PIPE SLOPES TO PUMP (MAX ELEV 343'-0")

4" BLIND FLANGE FOR TEMP DRAIN

EL 344' TYP BOTH POOLS

ELEV 340'-6" TYP BOTH POOLS

ELEV 305'-0"

EL 305'

S1 SIPHON BREAK EL 332'0"

EL 323'-6"

304L

## NOTES

1. VALVE POSITIONS SHOWN FOR REFERENCE ONLY. ACTUAL POSITIONS CONTROLLED BY PROCEDURES.
2. ALL INSTRUMENT TAG NUMBERS ARE PREFIXED BY SYSTEM DESIGNATOR UNLESS OTHERWISE NOTED.
3. SET POINT VALUES FOR RELIEF VALVES TO BE FOUND IN THE APPLICABLE ENGINEERING SETPOINT DATABASE.
4. VALVES ARE SHOWN IN NORMAL OPERATING POSITIONS OF COOLING AND FILTERING WATER IN SPENT FUEL POOL B. USING SF-P1A AND SF-C1A FOR COOLING.
5. ALL PIPING IS PIPE SPEC ▷ SEISMIC CLASS AS NOTED,& NUCLEAR CLASS N-3 (EXCEPT AS NOTED)
6. B & W SUPPLIED INSTRUMENTION IS DENOTED WITH AN ASTERISK.
7. FOR DESIGN CONDITIONS SEE B&W DWG 27553F.

| NO. | DWG. NO. | TITLE |
|---|---|---|
| 3 | 302-003 | COMPONENT & SYS ID INDEX |
| 2 | 302-002 | SYMBOLS INSTRUMENTATION |
| 1 | 302-001 | SYMBOLS FLOW DIAGRAM |

REFERENCES

Cad File Name : 302630_R32

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

Exelon. Nuclear

DRAWN MARK TETKOSKIE 8/11/11

DESIGN Stephen Palenchi 8/11/11

DESIGN MANAGER DATE

OWNER DATE

ENGINEERING MANAGER 8/11/11

INTERFACING CONCURRENCE

# SPENT FUEL COOLING SYSTEM FLOW DIAGRAM

TMI-1 | DWG. NO. 302-630 | SH. – | REV. 32 | SCALE: NONE | BA NO.

DWG NO. 302-630 SH. 1 REV. A

| REVISIONS | | |
|---|---|---|
| REV | ZONE | DESCRIPTIO |
| 8 | F-7 | REVISED TO INCORPORATE ECR-04-00778 REV. 0 |

FROM D-I-V52 302-640 (H-5)
FROM SF-V40 302-630 (C-2)
SPENT FUEL COOLNG SYSTEM
WDL-V52
302-690 (D-8)
FROM WDL-V45,46 THIS DWG (F-7)
FROM WDL-V47,48 THIS DWG (C-8)
302-690 (E-2)
FROM WDL-V70,71 THIS DWG (D-8)
TO WDL-T-5 302-693 (D-8)
FROM WDL-P-7A/B 302-690 (B-3)
DRAIN HDR. PT-6 302-690 (C-8)
DRAIN HDR. PT-6 302-690 (D-8)
FROM WDL-V2 302-690 (E-6)
VENT HDR. PT-5 302-690 (C-7)
SEE 302-671 AREA H-4
SEE 302-671 AREA G-4
SEE 302-671 AREA H-2
SEE 302-671 AREA G-2
SEE 302-671 AREA H-4
SEE 302-671 AREA G-2
1/2" AIR SEE 302-669
PRECOAT FILTER WDL-F-1A
PRECOAT FILTER WDL-F-1B
DEBORATING DEMINERALIZER WDL-K-1A
DEBORA DEMINERALIZER WDL-K-1B
RESIN TRAP WDL-F-2
CATION DEMINERALIZER WDL-K-2A
CATION DEMINERALIZER WDL-K-2B
RESIN TRAP WDL-F-3A
RESIN TRAP WDL-F-3B
(SEE NOTE 10)
TO WDL-V43 302-692 (G 10)
TO WDL-V44 302-692 (G-10)
TO SF-V43 302-630 (C-2)
THIS DWG (G-8)
VENT HDR. PT.5 302-690 (D-7)
THIS DWG (C-8)
TO WDL-T-4 302-693 (H-8)
THIS DWG (F-8)
TO WDL-V52 THIS DWG (G-8)
TO WDL-V363 302-692 (F-10)
FROM WDL-V434 THIS DWG (E-8)
302-692 (H-7)
TO WDL-T-4 302-693 (H-8)
TO WDL-V10 302-692 (C-10)
FROM MU-K1A,1B 302-660 (F-10)
302-690 (A-3)
FROM WDL-V358 THIS DWG (B-6)
302-670 (D-8)
302-152 (C-8)
TO WDL-V424 302-692 (G-8)
LOCAL SAMPLE
SAMPLE
VENT
AIR SUPPLY
TAGGED VALVE
SOLENOID HOOK-UP FOR VALVES MARKED *
NEUTRALIZER MIXING TANK WDL-T-8
NEUTRALIZER FEED TANK WDL-T-9
STORAGE TANK WDL-T-10
NEUTRALIZING ACID PUMP
RECLAIMED WATER 302-669 (E-3)
FROM FLOOR DRAINS
LAUNDRY WASTE STORAGE TANK WDL-T-12
WDL-P-15 LAUNDRY WASTE PUMP
TO WDL-T-9 THIS DWG (E-1)
TO MISC WASTE EVAP. 302-692 (H-10)
WDL-P-9A
WDL-P-9B
NEUTRALIZER PUMPS
NON-NUCLEAR S-III (CAUSTIC LINE ONLY)
NON-NUC N-3 S-II
S-II NON-NUC
S-III N-3

NOTES:
1. VALVE POSITION SHOWN FOR REFERENCE ONLY. ACTUAL POSITIONS CONTROLLED BY PROCEDURES.
2. ALL INSTRUMENT TAG NUMBERS ARE PREFIXED BY SYSTEM DESIGNATOR UNLESS OTHERWISE NOTED.
3. SET POINT VALUES FOR RELIEF VALVES TO BE FOUND IN THE APPLICABLE ENGINEERING SET POINT DATA BASE.
4. ALL PIPING ON THIS DRAWING IS ▷
5. ALL PIPING ON THIS DRAWING IS NUCLEAR CLASS N-3 UNLESS NOTED.
6. SEISMIC CLASS S-I. UNLESS NOTED.
7. ALL DRAINS AND LOCAL SAMPLES AFTER LAST VALVE SHALL BE S-II NON-NUCLEAR.
8. A DENOTES THAT NO SCHEMATIC EXISTS THEREFORE THE PHYSICAL DRAWING IS FLAGGED.
9. FOR REFERENCES SEE DRAWING 302-690.
10. VALVE INTERNALS FOR WDL-V365 REMOVED.

| NO. | DWG. NO. | TITLE |
|---|---|---|
| 3 | 302-003 | COMPONENT & SYS ID INDEX |
| 2 | 302-002 | SYMBOLS INSTRUMENTATION |
| 1 | 302-001 | SYMBOLS FLOW DIAGRAM |

REFERENCES

Cad File Name : 302691_R8

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

AmerGen

LIQUID WASTE DISPOSAL
FLOW DIAGRAM
PRECOAT FILTER, CATION & DEBORATING DEMINERALIZER, LAUNDRY, NEUTRALIZATION

| DRAWN | DATE |
|---|---|
| MARK TETKOSKIE | 09/2/04 |
| CHECKED | DATE |
| DESIGN VERIFIER | DATE |
| APPROVED | DATE |

TMI-1 | DWG. NO. 302-691 | SH. | REV. 8 | SCALE: NONE

INTERFACING CONCURRENCE | BA NO. –

DWG NO 302-691 SH

**ATTACHMENT 4**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

# TECHNICAL EVALUATION TO ASSESS BWST CLEANUP PATH PIPE STRESS

# E C R Printout

ECR NUMBER: TM 15-00252 000 ECR TYPE: EEC

ASSIGNED ORG: TEDM
ASSIGNED INDV: ZEPPOS,VP
INITIATOR: ZEPPOS
REQUEST ORG: TED
A/R NO: A2258102
PROJECT NO: _____ ___ _____

PRINT DATE/TIME: 06/24/15 13:43
REQUIRED DATE: 07/02/15
ECR STATUS: APPVD
STATUS DATE: 06/24/15
INIT. DATE: 06/16/15
A/R STATUS: ASIGND

A/R SUBJECT: TECHNICAL EVALUATION TO ASSESS BWST CLEANUP PATH PIPE STRESS

---

## A. IDENTIFICATION:

SYSTEM: 212 COMP ID: TM 1 212 M TK DH-T-1
INIT OPER: Y QA CLASS: * POTL REPT: N
TECH SPEC: N REQD IN MODES: _____
PAGES ATTACHED: Y NO. OF PAGES: 737 ID/DATE: DRY0 06/24/15

PROBLEM DESCRIPTION and PROPOSED DISPOSITION:

.
THIS TECHNICAL EVALUATION SUPPORTS RESOLUTION OF IR 2506588. IR 2506588 TRACKS ACTIONS FOR THE TEMPORARY RESTORATION OF THE BWST CLEANUP FLOWPATH WHILE ONLINE. SPECIFICALLY IR 2505688-26 IDENTIFIES THE NEED FOR A TECHNICAL EVALUTION THAT DEMONSTRATES THE BWST CLEAN-UP PIPING AS BEING CAPABLE OF WITHSTANDING AN SSE WITHOUT LOSS OF PRESSURE BOUNDARY INTEGRITY.

## B. EVALUATION:

50.59 REVIEW REQD: N ORIG 50.59 REVIEW AFFECTED: N 50.59 SE REQD: N
REPORTABLE: N DATE/TIME: _____ _____
STATION PROC/PROGRAM REVIEW COMPLT: Y CAUSE: I
FINAL OPERABILITY: COMP: Y SYSTEM: Y PLANT: Y
SSV NAME: _____ SSV DATE/TIME: _____ _____
SCHED CODE/WINDW: _____ 232 VPZ0 08/25/10
ADVANCED WORK AUTH: N FINAL DISP: UA INTERIM DISP: UA

APPROVED DISPOSITION:

.
THIS TECHNICAL EVALUATION IS PROCESSED PER CC-AA-309-101, "ENGINEERING TECHNICAL EVALUATIONS". PER CC-AA-309-101, SECTION 1.2.4, TECHNICAL EVALUATIONS SHALL BE USED FOR:

.
"RESPONSES TO QUESTIONS ON ISSUES WHERE A TECHNICAL INTERPORETATION, TECHNICAL EVALAUTION, OR TECHNICAL GUIDANCE IS NEEDED, REGARDLESS OF DISCIPLINE."

E C R Printout

ECR NUMBER: TM 15-00252 000 ECR TYPE: EEC

IND. DESIGN REVIEW COMMENTS:

I HAVE PERFORMED AN OWNER'S ACCEPTANCE REVIEW PER CC AA-103 1003. COMMENTS HAVE BEEN PROVIDED TO THE VENDOR, AECOM, AND RESOLVED SATISFACTORILY. JUDGEMENTS USED TO ASSESS THE PIPING INTEGRITY FOR THIS TECHNICAL EVALUATION ARE APPROPRIATE. THESE INCLUDE THE ASSESSMENT OF THE SEISMIC CAPABILITIES FOR THE PRECOAT FILTER AND THE CATION DEMINERALIZERS, BASED ON THE CONSTRUCTION DRAWINGS AVAILABLE. THE PIPE STRESS ANALYSIS ADEQUATELY DEMONSTRATES THE PRESSURE BOUNDARY INTEGRITY FOLLOWING AN SSE. THIS TECHNICAL EVALUATION IS ASSESSED AS APPROPRIATE BASED ON CC-AA-309 101 SECTION 1.2.2, THAT TECHNICAL EVALUATIONS ARE APPROPRIATE FOR "ENSURING THAT ISSUES DO NOT DEGRADE THE DESIGN BASIS OF THE PLANT AND TO DOCUMENT JUSTIFICATION, WHICH SUPPORTS THIS CONCLUSION.

.

I HAVE PERFORMED AN OWNER'S ACCEPTANCE REVIEW PER CC AA-103 1003. COMMENTS HAVE BEEN PROVIDED TO THE VENDOR, AECOM, AND RESOLVED SATISFACTORILY. JUDGEMENTS USED TO ASSESS THE PIPE SUPPORTS FOR THIS TECHNICAL EVALUATION ARE APPROPRIATE. THE RESULTS AND CONCLUSIONS OF THIS TECHNICAL EVALUATION SUPPORT THE STATED PURPOSE OF DEMONSTRATING THE INTEGRITY OF THE BWST CLEANUP PIPING DURING AN SSE.

***

MANAGER REVIEW COMPLETE. A TECHNICAL EVALUATION PER CC-AA-309-101 IS THE PROPER VEHICLE FOR THIS WORK, AND THE WORK IS TECHNICALLY AND PROCEDURALLY ACCURATE AND COMPLIANT. ALL TMI ENGINEERING COMMENTS HAVE BEEN INCORPORATED.

C. DOCUMENT CHANGES:

DOC CHANGES REQUIRED: N DOC SCREEN STATUS: _____

AFFECTED DOCUMENTS:

# E C R Printout

ECR NUMBER: TM 15-00252 000 ECR TYPE: EEC

D. APPROVALS:

| | Name | User ID | Date |
|---|---|---|---|
| INTERFACING GROUPS: | AECOM CREATED THIS DOCUMENT | VPZ0 | 06/22/15 |
| | SEE TECH EVAL FOR SIGNAGE FROM | VPZ0 | 06/22/15 |
| | VENDOR | VPZ0 | 06/22/15 |
| CAQ: ___ ISSUE NBR: _____ | | | |
| RESP ENGINEER: | ZEPPOS,VP (MECHANICAL OAR) | VPZ0 | 06/22/15 |
| IND REVIEWER: | YERKES,DR (CIVIL/STRUC OAR) | DRY0 | 06/24/15 |
| MANAGER: | BENNETT, P.A. (TMI ENGR MGR). | PAB0 | 06/24/15 |

E. ECR WORK COMPLETION NOTIFICATION:

WORK REQUIRED: Y
AUTO CLOSE: N VPZ0

FILM ID: _____ BLIP NBR: _____ BOX NBR: _____

A2258102 50 ACCEPT 06/18/15
DESC: ENSURE EEC 15-00252 DOES NOT GO TO HISTORY UNTIL DESIR

| EEC 15-00252, Revision 0 | Borated Water Piping Technical Evaluation for Safe Shutdown (SSE) Capability | Page 1 of 11 |
|---|---|---|

| | | |
|---|---|---|
| Prepared by: | Yuhua Chen/*Supti Lahiri | 06/23/15 |
| Reviewed by: | Satish Jena/*Samir Dutta | 06/23/15 |
| Approved by: | Doug Beutel | 06/23/15 |

*: For Page 7, Equipment Anchorage only.

(See Attachments A, Page A1 and Attachment B, Page B1 for additional signatures)

## 1.0 REASON FOR EVALUATION / SCOPE

The purpose of this technical evaluation is to seismically evaluate the existing Borated Water Storage Tank (BWST) cleanup/recirculation piping, including pipe stress and pipe support structural capacity. This Technical Evaluation demonstrates this piping system can withstand a SSE without loss of pressure boundary integrity, including an assessment of the pipe support function. This evaluation is not intended to constitute a permanent design change.

## 2.0 DESIGN INPUTS

See References 2, 8 through 18, and 21.

## 3.0 ASSUMPTIONS

1. Grouted penetrations are assumed to be anchors.
2. Thermal loading is assumed to be negligible as the piping system is considered to be "cold" with a maximum operating temperature of 165 °F. This methodology is consistent with the piping original construction analysis basis as found in Reference 28.
3. Seismic anchor movements for all the equipments are assumed to be negligible.
4. It is assumed the small bore piping is evaluated and supported to the span criteria procedure (Exhibit E of ES-014T, Reference 3) using seismic OBE acceleration values.
5. Original pipe support steel design is assumed to have been performed in accordance with standard AISC allowable stresses and AISC minimum weld sizes.
6. Not Used
7. Welds are assumed to be present where required even if not explicitly called out on the drawing. They are considered to be at least the length of one side of the smaller connecting member or four times the weld size and are assumed to be fillet welds for standard T-connections.
8. It is assumed that all one/two way supports were designed (including auxiliary steel and piping components such as U-bolts) to support the capacities in SP-5578 supplemental Order No.1 (Reference 8).

## 4.0 REFERENCES

1. USAS B31.1.0, Power Piping, 1967 Edition.
2. SYS-LL-TMI-1, Pipe Line List and Specification for TMI-1, Rev. 3.
3. ES-014T, Piping Design Standard for TMI-1, Rev. 2.
4. ES-022T, Seismic Criteria, Rev. 1.
5. TMI-1/FSAR, Updated Final Safety Analysis report, Update 18, April 2006.
6. CC-AA-309-1011, General Station Piping Analysis, Rev. 7.
7. Bentley AutoPIPE V8i (SELECT Series 5) Advanced Edition Version 09.06.01.11.
8. SP-5578, Specification Piping Supports for Three Mile Island Nuclear Station, Sep. 18, 1968.
9. ITT Grinnell Catalog PH81, Pipe Hangers.
10. Flow Diagram Drawing Number 302-630, Spent Fuel Cooling System, Rev. 32.
11. Flow Diagram Drawing Number 302-640, Decay Heat Removal, Rev. 84.
12. Flow Diagram Drawing Number 302-691, Liquid Waste Disposal, Rev. 8.
13. Pipe Support Drawings:
    a. DHH-142, Rev. 3.
    b. SFE-24, Rev. IA-0.
    c. SFE-32, Dated 01-01-1973.
    d. SFH-23, Rev. 1.
    e. SFH-112, Rev. 1.
    f. SFH-113, Rev. 1.
    g. WDE-99, Dated 07-07-1972
    h. WDE-101, Dated 07-07-1972.
    i. WDE-102, Dated 07-07-1972.
    j. WDE-103, Dated 10-17-1974.
    k. WDE-104, Dated 07-07-1972.
    l. WDE-105, Dated 07-07-1972.
    m. WDE-106, Dated 07-07-1972.
    n. WDE-107, Rev. 1.
    o. WDE-108, Dated 07-07-1972.
    p. WDE-109, Dated 07-07-1972.
    q. WDE-117, Dated 07-07-1972.
    r. WDE-118, Dated 07-07-1972.
    s. WDE-119, Dated 07-07-1972.
    t. WDE-120, Dated 07-07-1972.
    u. WDE-121, Dated 07-07-1972.
    v. WDE-122, Rev. 1.
    w. WDE-123, Dated 07-07-1972.
    x. WDE-127, Rev. 1.
    y. WDE-128, Rev. 1.
    z. WDE-129, Rev. 2.
    aa. WDE-130, Rev. 2.
    bb. WDE-131, Rev. 1.
    cc. WDE-132, Dated 07-07-1972.
    dd. WDE-133, Dated 07-07-1972.
    ee. WDE-134, Dated 07-07-1972.
    ff. WDE-135, Rev. 1.

gg. WDE-136, Dated 07-07-1972.
hh. WDE-137, Dated 07-07-1972.
ii. WDE-139, Dated 07-07-1972.
jj. WDE-140, Dated 07-07-1972.
kk. WDE-141, Rev. 1.
ll. WDH-230, Rev. 2.
mm. WDH-232, Rev. 2.
nn. WDH-235, Rev. 1.
oo. WDH-236, Rev. 1.
pp. WDH-237, Rev. 1.
qq. WDH-238, Rev. 1.
rr. WDH-239, Rev. 1.
ss. WDH-240, Rev. 1.
tt. WDH-241, Rev. 1.
uu. WDH-242, Rev. 1.
vv. WDH-243, Rev. 2.
ww. WDH-244, Rev. 1.
xx. WDH-245, Rev. 2.
yy. WDH-246, Rev. 2.
zz. WDH-247, Rev. 1.
aaa. WDH-248, Rev. 1.
bbb. WDH-249, Rev. 2.
ccc. WDH-250, Rev. 2.
ddd. WDH-252, Rev. 1.
eee. WDH-256, Rev. 1.
fff. WDH-257, Rev. 2.
ggg. WDH-258, Rev. 2.
hhh. WDH-259, Rev. 2.
iii. WDH-260, Rev. 1.
jjj. WDH-261, Rev. 1.
kkk. WDH-262, Rev. 2.
lll. WDH-265, Rev. 1.
mmm. WDH-266, Rev. 1.
nnn. WDH-267, Rev. 1.
ooo. WDH-271, Rev. 1.
ppp. WDH-272, Rev. 1.
qqq. WDH-273, Rev. 1.
rrr. WDH-275, Rev. 2.
sss. WDH-276, Rev. 2.
ttt. WDH-277, Rev. 1.
uuu. WDH-278, Rev. 1.
vvv. WDH-279, Rev. 1.
www. WDH-280, Rev. 1.
xxx. WDH-281, Rev. 1.
yyy. WDH-282, Rev. 1.

14. Calculation No. SF-52-A-1, Dated 02-08-1981.
15. Calculation No. SF-53-A-1, Dated 12-29-1980.
16. Walkdown Report:
    a. Cover Page of Walkdown Report (See Attachment C-1).
    b. List of Areas Related to Add. Supports for Pipe Stress Analysis (See Attachment C-2).

c. Areas (ISO) Related to Add. Supports for Pipe Stress Analysis (See Attachment C-3).
d. Piping Iso - Final (See Attachment C-4).
e. TMI Walkdown Support Table - Final (See Attachment C-5).
f. All Walkdown Pictures (See Attachment C-6).

17. TODI #5971-2015-028 (See Attachment D)
18. Ladish Catalog No. 55.
19. AISC Manual of Steel Construction, 9th Edition
20. TDR No. 211, Final Report to USNRC for IE Bulletin 79-02 Requirements at TMI Unit No. 1, Rev. 1.
21. Calculation No. DH-50-A-1, Dated 04-09-1981,
22. MathCad Version 15.0.
23. Microsoft Excel Version 14.
24. NRC IE Bulletin No. 79-02, March 8, 1979.
25. Specification SP-1101-53-008, Structural Criteria Used to Evaluate and Design Conduit/Cable Tran Unistrut Supports, Rev. 6.
26. Standard Review Plan (NUREG-0800), Section 3.8.4, Rev. 1.
27. OP-AA-108-115, Operability Determinations (CM-1), Rev. 16.
28. 04-4692-504, TMI Unit 1 Piping Analysis GAI/TMI-1CS/4687.
29. Typical Support Drawings, Drawing No. A-9459-HS-01 through HS-39.
30. Typical Support Hanger Drawings, Drawing No. DS-013, Sheets 1 through Sheet 27.
31. Design Input Record Identifier 5130-323-DI-1, Design Review NPS Piping Seismic Analysis, Rev. 0.
32. SQUG Report, SQ-TI-WDL-F-0001A, Precoat Filters, Rev. 000, Dated 01-01-1994.
33. SQUG Report, SQ-TI-WDL-F-0001B, Precoat Filters, Rev. 000, Dated 01-01-1994.
34. Drawing Number 157906, Cation Tank, Rev. C
35. Drawing Number E-422-041, Auxiliary Building Concrete Equipment Foundations Floor Elevation 305'-0", Rev. 6.
36. Drawing Number S-423-043, Aux. Bldg. EL. 305'-0" Floor Slab, Rev. 2.

## 5.0 IDENTIFICATION OF COMPUTER PROGRAMS

Bentley AutoPIPE V8i (SELECT Series 5) Advanced Edition Version 09.06.01.11 (Reference 7) - AECOM PC #B8188 located in Warrenville, IL.

MathCad Version 15.0 (Reference 22) and Microsoft Excel Version 14 (Reference 23) have been used to prepare this analysis. In accordance with Procedure CC-AA-309-1001, Revision 8, Section 4.3.6.2, personal productivity software is exempt from the Procedure IT-AA-101. The programs have been utilized as an analytical tool only to perform mathematical computations, which have been verified by the preparer and the reviewer.

## 6.0 METHOD OF ANALYSIS

### Large Bore Piping:

The large bore piping (2 ½" and larger) connected to Precoat Filters WDL-F1-A and WDL-F1-B are evaluated as three separate AutoPIPE models: Inlet, Outlet, and Drain (see Attachment A for details). These models are prepared based on the walkdown isometric drawings (Reference 16), flow diagram drawings (References 10, 11 and 12), support drawings (Reference 13), and generic valve information for ITT diaphragm valves (Reference 17).

Supports labeled as R-## are considered to be standard u-bolt guide-type supports (See References 29 and 30). Additional guidance is taken from Reference 3, Piping Design Standard ES-014T (i.e., +X is North, supports are considered to have a stiffness of 50,000 pounds/inch, piping dimensions for 3" pipe have a tolerance of 9", component weights have a tolerance of 20%). Minor dimensional changes are incorporated into the model to ensure proper alignment of cross-tie piping and shared supports. Specifically, the dimensional tolerances are utilized in the Outlet model to align the cross-tied piping near supports WDH-243 and WDH-244. As the maximum stresses for the Outlet piping model are less than 25% of their respective allowables, adequate margin exists to accommodate these minor dimensional changes.

Piping parameters are per SYS-LL-TMI-1 (Reference 2). Grinnell handbook (Reference 9, spring can stiffnesses), Ladish Catalog No. 55 (Reference 18, fitting dimensions), and TMI calculations (References 14 and 15) SF-52-A-1 and SF-53-A-1 (configuration details near stanchion anchors) are used for additional information incorporated into the model. Adequate nodal spacing is incorporated into the models.

Model boundaries are established at equipment nozzles, grouted penetrations (assumed to be anchors, see Assumption Section, Assumption #1), welded attachment anchors, and locations where two supports close together serve as a three-way restraint that approximates an anchor (i.e. supports SFE-32 (Reference 13.c) and SFH-112 (Reference 13.e)). Note that anchors WDH-266 (Reference 13.mmm) and WDH-271 (Reference 13.ooo) are credited for maintaining the integrity of adjacent isolation valves WDL-V51 and WDL-V52, respectively. Additional piping is modelled per walkdown photos (Reference 16) where necessary to establish a sufficient seismic boundary. The small bore piping restraints in the models are included to determine the impact of the small bore piping and support configuration on the large bore piping evaluated in the AutoPIPE models. The loads generated by AutoPIPE for these supports (marked as 'REF') in the seismic overlap sections of the model are not evaluated. Small bore piping and supports are addressed separately.

An additional AutoPIPE run is performed for the Inlet piping to address uplift of support WDH-272 (Node F02). In the Inlet (Uplift) AutoPIPE analysis, this support is removed from the model in order to determine the acceptability of the piping and supports without crediting the uplifted support. Results for both runs, Inlet and Inlet (Uplift), are considered.

All piping is analyzed for deadweight, pressure, and SSE loading. Loads are combined in accordance with TMI original design criteria (Reference 5). Seismic OBE horizontal spectra are per ES-022T (Reference 4). Vertical spectra are taken as 2/3 of horizontal spectra. SSE spectra are 2x OBE spectra. Using AutoPIPE (Reference 7), PVRC spectra are generated from the 2% and 5% damping Aux. Bldg. spectra, Elevation 329'-0", provided in ES-022T. The WDL piping system is at or below elevation 320'-0", so use of spectra for a higher elevation is conservative.

Thermal loading is assumed to be negligible as the piping system is considered to be "cold" with a maximum operating temperature of 165 °F (see Assumption Section, Assumption #2). This methodology is consistent with the piping original construction analysis basis as found in Reference 28.

Seismic anchor movements for all the equipment are assumed to be negligible (see Assumption Section, Assumption #3).

Piping stresses are calculated using AutoPIPE (Reference 7) and compared to the code allowables listed on USAS B31.1.0 (Reference 1). For stanchions on fittings (i.e. elbows) conservatively high SIFs are considered. For the Inlet model, this results in a high stress point at Node E14. The second highest stress point is also reported to give a more accurate depiction of the actual stress levels in the rest of the system.

All seismic piping displacements are checked to ensure that movements stay within the 1" allowable dynamic displacement criteria as described in Reference 6, Section 5.5.2.1.

Valve accelerations are calculated using AutoPIPE (Reference 7) and compared to the allowables.

**Large Bore Piping Supports:**

Pipe supports are evaluated based on the SSE loads taken form the pipe stress model output (See Attachment A). Support capacities are considered to be based on the span criteria loads as documented in SP-5578 (Reference 8). Whenever new loads exceed the existing capacities/loads, the new SSE loads were compared against a prorated SSE capacity (Attachment B, Page B2). If new loads exceed these capacities or information is missing, the support was evaluated on a one by one basis.

**Small Bore Piping and Piping Supports:**

It is assumed the small bore piping is evaluated and supported to the span criteria procedure (Exhibit E of ES-014T, Reference 3) using seismic OBE acceleration values (see Assumption Section, Assumption #4).

The subject large bore piping and associated pipe restraints were originally designed to the span criteria procedure. The AutoPIPE Seismic I (SSE) analysis of the large bore piping, documented in Attachment A, shows the large bore piping stresses are low (note that the only stresses significantly greater than 50% of their respective allowables are overly conservative stresses evaluated at a node point consisting of a stanchion on an elbow) and support loads are within the design limits. Given that the small bore piping was also designed to the span criteria, the analysis results of the large bore piping would indicate that the small bore piping stresses are also within the stress allowables and the small bore pipe support loads are within the support design limits. Therefore, the small bore piping within the pressure boundary of the BWST system is acceptable without any further analysis.

**Equipment Anchorage:**

The seismic adequacy of the anchorage of Precoat Filters WDL-F-1A and WDL-F-1B were verified by the References 32 and 33 SQUG reports.

Anchorage of Cation Demineralizer Tanks WDL-K-2A & 2B is evaluated below:

1. Drawing 157906 (Reference 34) provided the following information:
   a. The tank is approximately 8 ft. tall
   b. The bottom of the tank is approximately 1 ft. above the floor
   c. The flooded weight of the tank is 8,000 pounds
2. Drawings E-422-041 (Reference 35) and S-423-043 (Reference 36) provided the following information:
   a. The tank is anchored to the Auxiliary Building concrete floor slab at El 305'-5"
   b. The centerline spacing of the 4 tank legs is 2'-8½" = 2.7'
   c. The legs are anchored to the floor slab with 7/8" sleeved bolts that are attached to a 4' x 4" x ½" plate embedded in the floor approximately 1'-5"
3. Per ES-022T (Reference 4)
   a. Section 5.2.5 – Sum the absolute response of the vertical and worse case horizontal
   b. Section 5.1.2
      i. SSE horizontal spectra is 2 x OBE horizontal spectra
      ii. Vertical Spectra is to be taken as 2/3 of the horizontal spectra
   c. Section 5.2.8 conservatively use 2% damping
   d. Exhibit B-T-01 – the peak of the OBE spectra is 0.72 g

AHSSE = 2 x 0.72 = 1.44 g

AHVERT = 2/3 (1.44) = 0.96 g < 1 g, therefore there is no net vertical tension on the bolts due to vertical seismic

Overturning Moment

Mo = 5ft x 8kip x 1.44 = 57.6 ft-kip

Anchor Bolt Forces

Vb = 8kip x 1.44/4 = 2.88 kip/bolt

Tb = Mo /2.7 ft./ 2 = 57.6/ 2.7/ 2 = 10.66 kip/bolt

These loads are well within the capability of a 7/8" embedded bolt, as shown in Table C.3-1 of the GIP, therefore the Cation Demineralizer Tank's anchorage is adequate to support the tank under an SSE loading.

## 7.0 NUMERIC ANALYSIS

### 1.0 Piping Stress

Per Attachment A, the summary of the maximum piping stresses are:

a. Outlet Model, Pages A287 – A290, Point F02:

Maximum sustained stress = 2776 psi allowable = 16685 psi Ratio = 0.17

Maximum occasional stress = 6526 psi allowable = 30033 psi Ratio = 0.22

b. Inlet Model, Pages A443 – A446, the first and second highest stress points:

Point E14 N (Stanchion on Elbow)

Maximum sustained stress = 14743 psi allowable = 16685 psi Ratio = 0.88

Maximum occasional stress = 26945 psi allowable = 30033 psi Ratio = 0.90

Point G06

Maximum sustained stress = 8141 psi allowable = 16685 psi Ratio = 0.49

Maximum occasional stress = 15187 psi allowable = 30033 psi Ratio = 0.51

c. Inlet Model (Uplift), Pages A598 – A601, the first and second highest stress points:

Point E14 N (Stanchion on Elbow)

Maximum sustained stress = 14743 psi allowable = 16685 psi Ratio = 0.88

Maximum occasional stress = 26781 psi allowable = 30033 psi Ratio = 0.89

Point G06

Maximum sustained stress = 8141 psi allowable = 16685 psi Ratio = 0.49

Maximum occasional stress = 15130 psi allowable = 30033 psi Ratio = 0.50

d. Drain Model, Pages A645 – A647:

Maximum sustained stress = 1082 psi allowable = 16685 psi Ratio = 0.06 (Point A05)

Maximum occasional stress = 2441 psi allowable = 30033 psi Ratio = 0.08 (Point A02)

All piping stresses are below their respective allowables and are acceptable.

### 2.0 Seismic Displacement

Per Attachment A, Pages A101- A150 (Outlet Model), A352- A374 (Inlet Model), A507 – A529 (Inlet Model – Uplift) and A634 – A636 (Drain Model), the maximum seismic displacements within the analysis boundary are less than 1" and are acceptable.

### 3.0 Valve Accelerations

Per Attachment A, Pages A80- A100 (Outlet Model), A342- A351 (Inlet Model), A497 – A506 (Inlet Model – Uplift) and A632 – A633 (Drain Model), the maximum valve accelerations of all valves are less than 1g and are acceptable.

## 4.0 Equipment Nozzle Loads

Per Attachment A, Pages A176, A178, A389, A390, A544, A545 and A639, the equipment nozzle loads of all equipment are (Unit - lbs, ft-lbs):

| Equipment ID | Model | Node | Fx | Fy | Fz | Mx | My | Mz |
|---|---|---|---|---|---|---|---|---|
| WDL-F-1A-OUTLET | Outlet | A00 | 17 | 63 | 17 | 0 | 11 | 46 |
| WDL-F-1B-OUTLET | Outlet | D03 | 17 | 63 | 17 | 0 | 11 | 46 |
| WDL-F-1A-INLET | Inlet* | A00 | 23 | 88 | 24 | 0 | 18 | 71 |
| WDL-F-1B-INLET | Inlet* | C06 | 23 | 88 | 24 | 0 | 18 | 71 |
| WDL-F-1A-DRAIN | Drain | A16 | 51 | 26 | 57 | 12 | 137 | 22 |
| WDL-F-1B-DRAIN | Drain | A00 | 80 | 27 | 106 | 48 | 11 | 27 |

*: for both Inlet and Inlet (Uplift) models

Piping stresses near the Precoat Filter nozzles are very low (less than 10% of their respective Code allowables) and the nozzles loads (shown above) are reasonably low. Therefore, the loads on the Precoat Filter nozzles are acceptable by engineering judgement.

The Cation Demineralizer Tank nozzles are connected to small bore piping, which is evaluated using simplified methods noted in Section 6.0 of this technical Evaluation. Since there is no detailed analysis for the small bore piping, there are no values for the forces and moments acting on the nozzles of the Cation Demineralizer Tanks, however, the forces and moments should be reasonable as per the assessment in Section 6.0. Since the Cation Demineralizer Tanks are designed to the requirements of ASME III Class C and are inherently rugged, they should handle any reasonable loads on the nozzles. Based on these reasons above, the Cation Demineralizer Tank nozzles are acceptable by engineering judgement.

## 5.0 Pipe Support Loads

Per Attachment B, Page B10, all pipe supports evaluated were determined to be structurally adequate for the applied loads.

## 8.0 RESULTS / CONCLUSIONS

The qualifications of all associated piping stresses, valve accelerations, pipe seismic displacements, equipment nozzle loads and pipe support loads as documented above, demonstrate that liquid radwaste piping used for cleanup/recirculation of the Borated Water Storage Tank (BWST) will withstand a SSE without loss of pressure boundary integrity.

## 9.0 DAR Responses

**4.1.4.1 Identify Basic SSC Functions**
The Liquid Waste Disposal System (WDL) provides operating service functions to the reactor coolant system and spent fuel pools in addition to the collection, containment and processing of miscellaneous wastes for reuse or disposal.

WDL provides for the recovery of concentrated boric acid and purified water from the reactor coolant, the refueling water and the spent fuel pool water processed through the system.

**4.1.4.2 Identify Safety Classification of Configuration Change**
The Technical Evaluation is classified as safety related.

**4.1.4.3 Identify Seismic Classification of SSC**
The existing WDL piping used for cleanup/recirculation of the BWST is Seismic Class II. This piping must be capable of sustaining an SSE (Seismic Class I) without loss of pressure boundary integrity.

**4.1.7 Specifications, Codes, Standards, or Regulatory Requirements**
The piping system code of record is USAS B31.1-1967.

**4.1.16 Review the OPEX Databases**
NRC IN 2012-01 provides examples in which licensees failed to recognize various seismic considerations and system alignment issues that could impact safety. The NRC also identified examples in which licensees failed to recognize that aligning non-seismic piping to the RWST would require TS LCO action statement entry, system modifications or license amendments.

**4.1.19 Determine if Operational Requirements have changed**
Currently there is no BWST cleanup path since the Seismic Class II piping is isolated from the BWST. Evaluation of this Seismic Class II piping for Seismic Class I loading and verification of pressure boundary integrity will allow interim use of the original cleanup piping prior to and after the October 2015 TMI refueling outage.

The current operational restriction may be lifted with validation of the piping system pressure boundary integrity for SSE loading.

**4.1.33 Identify Mechanical, Hydraulic, and HVAC System Requirements**
The Seismic Class II WDL piping has been analyzed for Seismic Class I loading. The evaluation demonstrates that the piping can withstand an SSE without loss of pressure boundary integrity and the pipe supports to maintain their required support function.

**4.1.38 Identify Civil/Structural Requirements**

The piping and supports have been analyzed to Seismic Class I loading, the piping was demonstrated to maintain its pressure boundary and the supports to maintain their required support function.

Associated attachments for this Technical Evaluation are embedded below.


EEC 15-00252, Rev. 0, Attachment A.pdf


EEC 15-00252, Rev. 0, Attachment B.pdf


EEC 15-00252, Rev. 0, Attachment C-1, Co


EEC 15-00252, Rev. 0, Attachment C-2, Lis


EEC 15-00252, Rev. 0, Attachment C-3, Ar


EEC 15-00252, Rev. 0, Attachment C-4, Pi


EEC 15-00252, Rev. 0, Attachment C-5, TI


EEC 15-00252, Rev. 0, Attachment C-6, All


EEC 15-00252, Rev. 0, Attachment D, TOD

| Attachment | No. of pages |
|---|---|
| Attachment A – AutoPIPE Analyses | 651 |
| Attachment B – Structural Evaluation of Pipe Supports | 10 |
| Attachment C1 – Walkdown Observation Record | 1 |
| Attachment C2 – List of Piping Areas & Walkdown Summary | 1 |
| Attachment C3 – Piping Isometric Showing Walkdown Areas | 2 |
| Attachment C4 – Piping Isometric Showing Support Numbers | 2 |
| Attachment C5 – List of Pipe Supports & Walkdown Summary | 3 |
| Attachment C6 – Walkdown Photographs | 47 |
| Attachment D – BWST Cleanup, TODI 5971-2015-028 | 6 |
| Attachment E – PE Stamp | 1 |

**AutoPIPE Analyses**

COMPUTER PROGRAM & VERSION: Bentley AutoPIPE V8i (SELECT Series 5) Advanced Edition Version 09.06.01.11 – AECOM PC # B8188 located in Warrenville, IL

| INPUT/OUTPUT FILE NAME | Description |
|---|---|
| Outlet (AECOM) | Model of the large bore outlet piping for precoat filters WDL-F1-A and WDL-F1-B. |
| Inlet (AECOM) | Model of the large bore inlet piping for precoat filters WDL-F1-A and WDL-F1-B. |
| Inlet-Uplift (AECOM) | Inlet piping model with support WDH-272 removed at Node F02 to determine the acceptability of the system without crediting this rod hanger support, which experiences uplift. |
| Drain (AECOM) | Model of the large bore drain piping for precoat filters WDL-F1-A and WDL-F1-B. |

**Prepared By:** Jeffrey Ross/ Jeffrey Ross **Date:** 6/22/15

**Reviewed By:** Satish Jena/ Satish Jena **Date:** 6/22/15

Review Method and Results of Review:
A detailed independent technical review was performed. Inputs and reasonableness of the output have been verified. The correct design considerations were utilized. The evaluation results are consistent with the purpose.

**ATTACHMENT 5**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

**PROPOSED MARK-UP PROCEDURE OP-TM-212-501,**
**"CLEANUP OF THE BWST"**

# CLEANUP OF THE BWST

## 1.0 PURPOSE

This procedure provides guidance to recirculate and clean up the BWST, through either Precoat Filter and, if required, either or both Cation Demineralizers.

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

### 3.1 Precautions

3.1.1 To avoid loss of the precoat, do not throttle flow through a Precoat Filter to less than 60 gpm at any time.

### 3.2 Limitations

3.2.1 To prevent damage to Precoat Filters, do not exceed 150 psig inlet pressure to WDL-F-1A and WDL-F-1B.

3.2.2 To prevent damage to Precoat Filters, do not exceed a differential pressure of 20 psi across WDL-F-1A or WDL-F-1B.

3.2.3 To prevent damage to Precoat Filters, do not exceed 150 gpm flow rate through a single Precoat Filter (WDL-F-1A or WDL-F-1B).

3.2.4 To prevent damage to Precoat Filters resin or Cation Demineralizers resin, do not exceed 120 °F inlet temperature.

3.2.5 To prevent channeling of Cation Demineralizer resin, do not exceed 70 gpm flow rate through a Cation Demineralizer (WDL-K-2A or WDL-K-2B).

3.2.6 To prevent channeling of Cation Demineralizers resin, do not exceed 140 gpm flow rate through both Cation Demineralizers (WDL-K-2A or WDL-K-2B).

3.2.7 To prevent damage to Cation Demineralizers, do not exceed a differential pressure of 35 psi across WDL-K-2A or WDL-K-2B.

3.2.8 To prevent damage to Cation Demineralizer Resin Trap filter elements, do not exceed a differential pressure of 28 psi across WDL-F-3A or WDL-F-3B.

3.3 Prerequisites

3.3.1 **VERIFY** the Liquid Waste Disposal System is in the Operating Mode IAW OP-TM-232-000, "Liquid Waste Disposal System." ___

3.3.2 **VERIFY** the Decay Heat Removal System is in any Mode IAW OP-TM-212-000, "Decay Heat Removal System." ___

3.3.3 **VERIFY** **no** conflicting cleanup processes in progress in SF/WDL systems. ___

3.3.4 **VERIFY** BWST liquid temperature on DH4-TI (CC) is less than 120°F. ___

## 4.0 MAIN BODY

4.1 **IDENTIFY** one Precoat Filter to be used for the cleanup process. ___

"A" Precoat Filter _____

"B" Precoat Filter _____

4.2 **If** required for the cleanup process, **then IDENTIFY** Cation Demineralizer(s) to be used for the cleanup process. ___

"A" Cation Demineralizer _____

"B" Cation Demineralizer _____

4.3 **RECORD** the required cleanup flowrate: ___

| Flow Rate |
|---|
| gpm |

4.4 **RECORD** initial BWST level, and PPC point used to determine level. ___

| Initial BWST Level | PPC Point Used (Circle) | |
|---|---|---|
| | A0486 | A0487 |

4.5 **VERIFY** SF-P-1A Mode Switch is **not** in the FILL FUEL TRANS CANAL position **or** the DRAIN FUEL TRANS CANAL position. ___

4.6 **VERIFY** SF-P-1B Mode Switch is **not** in the FILL FUEL TRANS CANAL position **or** the DRAIN FUEL TRANS CANAL position. ___

4.7 **If** SF-P-1A is **not** running, **then VERIFY** SF-P-1A is in PULL TO LOCK. ___

4.8 **If** SF-P-1B is **not** running, **then VERIFY** SF-P-1B is in PULL TO LOCK. ___

4.9 **If** PPC is available, **then PLACE** PPC point A0486 or A0487 on trend to monitor for BWST level changes. ___

4.10 **If** PPC is **not** available, **then MONITOR** DH-LI-808A or DH-LI-809A for BWST level changes. ___

4.11 **VERIFY** the following valves are Closed: ____

- SF-V-37 ____
- SF-V-35 ____
- SF-V-21 ____
- SF-V-18 ____
- SF-V-41 ____
- SF-V-42 ____
- SF-V-49 ____
- SF-V-44 ____
- SF-V-46 ____
- SF-V-47 ____

4.12 **OPEN** the following valves: ____

- SF-V-19 ____
- SF-V-20 ____
- SF-V-43 ____
- SF-V-45 ____
- DH-V-28 ____

NOTE: SF-V-36 has failed in the Open position. Refer to PIMS AR A2332040 and ACPS 2013-101.

4.13 **VERIFY** SF-V-36 is Open. ____

4.14 **If** cleanup process is through "A" precoat filter only, **then OPEN** the following valves: ____

- WDL-V-63 ____
- WDL-V-68 ____

4.15 **If** cleanup process is through "B" precoat filter only, **then OPEN** the following valves: ____

- WDL-V-64 ____
- WDL-V-69 ____

4.16 **If** cleanup process is through "A" precoat filter and "A" Cation Demineralizer, **then OPEN** the following valves: ____

- WDL-V-63 ____
- WDL-V-65 ____
- WDL-V-70 ____

4.17 **If** cleanup process is through "A" precoat filter and "B" Cation Demineralizer, **then OPEN** the following valves: ____

- WDL-V-63 ____
- WDL-V-65 ____
- WDL-V-67 ____
- WDL-V-71 ____

4.18 **If** cleanup process is through "A" precoat filter and both Cation Demineralizers, **then OPEN** the following valves: ____

- WDL-V-63 ____
- WDL-V-65 ____
- WDL-V-67 ____
- WDL-V-70 ____
- WDL-V-71 ____

4.19 **If** cleanup process is through "B" precoat filter and "B" Cation Demineralizer, **then OPEN** the following valves: ____

- WDL-V-64 ____
- WDL-V-66 ____
- WDL-V-71 ____

4.20 **If** cleanup process is through "B" precoat filter and "A" Cation Demineralizer, **then OPEN** the following valves: ___

- WDL-V-64 ___
- WDL-V-66 ___
- WDL-V-67 ___
- WDL-V-70 ___

4.21 **If** cleanup process is through "B" precoat filter and <u>both</u> Cation Demineralizers, **then OPEN** the following valves: ___

- WDL-V-64 ___
- WDL-V-66 ___
- WDL-V-67 ___
- WDL-V-70 ___
- WDL-V-71 ___

4.22 **THROTTLE OPEN** SF-V-40 to between 1 and 1 ½ turns open. ___

4.23 **START** SF-P-2. ___

4.24 Perform the following to initiate cleanup process:

1. **RECORD** Precoat Filter to be used for BWST cleanup: ___

   ___ "A" Precoat Filter ___ "B" Precoat Filter

2. **PRESS and HOLD** the INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel for the Precoat Filter being used for BWST cleanup. ___

3. **When** <u>either</u> of the following conditions occur, **then RELEASE** the INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel: ___

   - Greater than 60 gpm flow is indicated on WDL-FR-126. ___
   - The INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel has been depressed for 10 seconds. ___

4. **RECORD** process start date **and** time. ___

| Start Date | Start Time |
|---|---|
| | |

4.25 **If** no flow is indicated on WDL-FR-126, **then** perform the following: ___

1. **THROTTLE OPEN** SF-V-40 as required to obtain greater than 60 gpm flow when cleanup process is initiated. ___
2. **GO TO** Step 4.24. ___

4.26 **IAAT** any of the following limits are approached:

- 150 gpm through one Precoat Filter on WDL-FR-126
- 140 gpm through both Cation Demineralizers on WDL-FR-126
- 70 gpm through one Cation Demineralizer on WDL-FR-126
- 20 psid on WDL-DPI-343 (WDL-F-1A) **or** WDL-DPI-344 (WDL-F-1B)
- 35 psid on WDL-DPI-348 (WDL-K-2A) **or** WDL-DPI-349 (WDL-K-2B)
- 28 psid on WDL-DPI-350 (WDL-F-3A) **or** WDL-DPI-351 (WDL-F-3B)

**or** cleanup flow is **not** at desired flow rate,

**then THROTTLE** SF-V-40 as required to maintain flow as close as possible to the desired flow rate while maintaining flow and differential pressure within limits. ☐

4.27 **If** "A" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___

1. **PLACE** CA-P-5A control switch in Auto. ___
2. **PLACE** CA-V-145A control switch in Auto. ___
3. **PLACE** CA-V-202A control switch in Auto. ___

4.28 **If** "B" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___

1. **PLACE** CA-P-5B control switch in Auto. ___
2. **PLACE** CA-V-145B control switch in Auto. ___
3. **PLACE** CA-V-202B control switch in Auto. ___

4.29 **IAAT** any of the following occur:

- BWST level is **not** stable
- Flow is lowered to less than or equal to 60 gpm to maintain differential pressure within limits
- Precoat Filter trips into Hold mode when lowering flow to maintain differential pressure within limits
- Shift Management directs termination of transfer

**then GO TO** Step 5.1. ☐

## 5.0 RETURN TO NORMAL

5.1 **When** termination of BWST recirculation and cleanup is required, **then CONTINUE.** ___

5.2 **If** Precoat Filter is **not** in Hold mode, **then** perform the following: ___

1. **ESTABLISH** communications between Precoat Panel operator and operator at SF-V-40. ___
2. **THROTTLE CLOSED** SF-V-40 as required to obtain 60 gpm indicated on WDL-FR-126. ___

5.3 Perform the following to manually place the Precoat Filter on hold:

1. **If** "A" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___
   A. **PLACE** CA-V-202A control switch in Open. ___
   B. **PLACE** CA-V-145A control switch in Open. ___
   C. **PLACE** CA-P-5A control switch in On. ___
2. **If** "B" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___
   A. **PLACE** CA-V-202B control switch in Open. ___
   B. **PLACE** CA-V-145B control switch in Open. ___
   C. **PLACE** CA-P-5B control switch in On. ___

5.4 **PLACE** SF-P-2 control switch in Normal After Stop. ___

5.5 **RECORD** process stop date **and** time. ___

| Stop Date | Stop Time |
|---|---|
| | |

5.6 **If** cleanup process was through "A" Precoat Filter only, **then CLOSE** the following valves: ___

– WDL-V-63 ___

– WDL-V-68 ___

5.7 **If** cleanup process was through "B" Precoat Filter only, **then CLOSE** the following valves: ___

- WDL-V-64 ___
- WDL-V-69 ___

5.8 **If** cleanup process was through "A" precoat filter and "A" Cation Demineralizer, **then CLOSE** the following valves: ___

- WDL-V-63 ___
- WDL-V-65 ___
- WDL-V-70 ___

5.9 **If** cleanup process was through "A" precoat filter and "B" Cation Demineralizer, **then CLOSE** the following valves: ___

- WDL-V-63 ___
- WDL-V-65 ___
- WDL-V-67 ___
- WDL-V-71 ___

5.10 **If** cleanup process was through "A" precoat filter and <u>both</u> Cation Demineralizers, **then CLOSE** the following valves: ___

- WDL-V-63 ___
- WDL-V-65 ___
- WDL-V-67 ___
- WDL-V-70 ___
- WDL-V-71 ___

5.11 **If** cleanup process was through "B" precoat filter and "B" Cation Demineralizer, **then CLOSE** the following valves: ___

- WDL-V-64 ___
- WDL-V-66 ___
- WDL-V-71 ___

5.12 **If** cleanup process was through "B" precoat filter and "A" Cation Demineralizer, **then CLOSE** the following valves: ___

- WDL-V-64 ___
- WDL-V-66 ___
- WDL-V-67 ___
- WDL-V-70 ___

5.13 **If** cleanup process was through "B" precoat filter and <u>both</u> Cation Demineralizers, **then CLOSE** the following valves: ___

- WDL-V-64 ___
- WDL-V-66 ___
- WDL-V-67 ___
- WDL-V-70 ___
- WDL-V-71 ___

5.14 **CLOSE** the following valves: ___

- DH-V-28 ___
- SF-V-40 ___
- SF-V-43 ___
- SF-V-45 ___

NOTE: Performance of the following steps in order will ensure a vent path exists and prevent hydraulic locking of large diaphragm operated valves such as SF-V-20.

5.15 **CLOSE** SF-V-19. ___

5.16 **OPEN** SF-V-42. ___

5.17 **CLOSE** SF-V-20. ___

5.18 **CLOSE** SF-V-42. ___

NOTE: The same PPC point that was used to determine initial BWST level should be used in the following step.

5.19 **RECORD** final BWST level, and PPC point used to determine level. ___

| Final BWST Level | PPC Point Used (Circle) |
|---|---|
| | A0486 A0487 |

5.20 **CALCULATE** BWST level change by subtracting Final BWST Level from Initial BWST Level. ___

_____ - _____ = _____
Initial BWST Level Final BWST Level BWST Level Change

5.21 **If** the absolute value of BWST Level Change is greater than 0.1 feet, **then** perform the following: ___

1. **VERIFY** TS 3.3.1.1.a (BWST volume) **and** TS 3.3.1.3.b (NaOH Tank / BWST differential level) requirements continue to be met. ___
2. **INITIATE** an IR to investigate cause of BWST level change. ___

## 6.0 REFERENCES

6.1 1104-29C, Spent Fuel Cleanup Processes, Rev. 32 Section 5.0

## 7.0 ATTACHMENTS

7.1 Device Locator List

**ATTACHMENT 7.1**
**Device Locator List**
Page 1 of 2

| DEVICE | DESCRIPTION | ELEV | BLDG | AREA |
|---|---|---|---|---|
| CA-P-5A-EX4 | CA-P-5A LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-P-5B-EX4 | CA-P-5B LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-145A-EX4 | CA-V-145A LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-145B-EX4 | CA-V-145B LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-202A-EX7 | CA-V-202A CONTROL SWITCH | 305 | AB | Precoat Panel |
| CA-V-202B-EX7 | CA-V-202B CONTROL SWITCH | 305 | AB | Precoat Panel |
| DH-V-28 | BWST Cleanup Return From SF Cooling | 305 | Yard | 1' East of BWST, 4' South of 24" Discharge Line |
| SF-P-2-EX7 | SF-P-2 Pistol Grip Ctl Sw (NSP,NST,PTL) | 305 | AB | Radwaste Panel |
| SF-V-18 | SF Pumps Suct Isolation Vlv From BWST | 281 | AB | North of Elevator, West Wall |
| SF-V-19 | SF-DHR X-Conn Isol Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-20 | SF Syst To BWST Isolation Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-21 | SF/FTC Isol Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-35 | SF-P2 Suct Vlv From Spent Fuel Cask Pit | 281 | AB | North of Elevator, West Wall |
| SF-V-36 | SF-P2 Suct Vlv From BWST Tank | 281 | AB | North of Elevator, West Wall |
| SF-V-37 | SF-P2 Suct Vlv From Fuel Pool A & B | 281 | AB | North of Elevator, West Wall |
| SF-V-41 | SF-P-2 Disch Isol Vlv To A SF Pool | 281 | AB | North of Elevator, West Wall |
| SF-V-42 | SF-P-2 Disch Isol Vlv To SF Fuel Cask Pit | 281 | AB | North of Elevator, West Wall |
| SF-V-43 | LWDS To Spent Fuel Syst Isol Valve | 281 | AB | North of Elevator, East Wall |
| SF-V-44 | SF System Isol Valve To DH-P-1A Suct | 281 | AB | North of Elevator, East Wall |
| SF-V-45 | SF System Isolation Valve To BWST | 281 | AB | North of Elevator, East Wall |

**ATTACHMENT 7.1**
**Device Locator List**
Page 2 of 2

| DEVICE | DESCRIPTION | ELEV | BLDG | AREA |
|---|---|---|---|---|
| SF-V-46 | LWDS Purif Line To A Spent Fuel Pool | 281 | AB | North of Elevator, East Wall |
| SF-V-47 | LWDS Purif Line To B Spent Fuel Pool | 281 | AB | North of Elevator, East Wall |
| SF-V-49 | SF-P-2 Priming Line Isol Vlv | 281 | AB | North of Elevator, West Wall |
| WDL-FR-126 | PRECOAT FILTER A/B INLET FLOW RECORDER | 305 | AB | Precoat Panel |
| WDL-V-63-EX7 | WDL-V-63 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-64-EX7 | WDL-V-64 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-65-EX7 | WDL-V-65 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-66-EX7 | WDL-V-66 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-67-EX7 | WDL-V-67 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-68-EX7 | WDL-V-68 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-69-EX7 | WDL-V-69 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-70-EX7 | WDL-V-70 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-71-EX7 | WDL-V-71 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |

# CLEANUP OF THE BWST

## 1.0 PURPOSE

This procedure provides guidance to recirculate and clean up the BWST, through either Precoat Filter and, if required, either or both Cation Demineralizers.

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

### 3.1 Precautions

3.1.1 To avoid loss of the precoat, do not throttle flow through a Precoat Filter to less than 60 gpm at any time.

### 3.2 Limitations

3.2.1 To prevent damage to Precoat Filters, do not exceed 150 psig inlet pressure to WDL-F-1A and WDL-F-1B.

3.2.2 To prevent damage to Precoat Filters, do not exceed a differential pressure of 20 psi across WDL-F-1A or WDL-F-1B.

3.2.3 To prevent damage to Precoat Filters, do not exceed 150 gpm flow rate through a single Precoat Filter (WDL-F-1A or WDL-F-1B).

3.2.4 To prevent damage to Precoat Filters resin or Cation Demineralizers resin, do not exceed 120 °F inlet temperature.

3.2.5 To prevent channeling of Cation Demineralizer resin, do not exceed 70 gpm flow rate through a Cation Demineralizer (WDL-K-2A or WDL-K-2B).

3.2.6 To prevent channeling of Cation Demineralizers resin, do not exceed 140 gpm flow rate through both Cation Demineralizers (WDL-K-2A or WDL-K-2B).

3.2.7 To prevent damage to Cation Demineralizers, do not exceed a differential pressure of 35 psi across WDL-K-2A or WDL-K-2B.

3.2.8 To prevent damage to Cation Demineralizer Resin Trap filter elements, do not exceed a differential pressure of 28 psi across WDL-F-3A or WDL-F-3B.

3.3 Prerequisites

3.3.1 **VERIFY** the Liquid Waste Disposal System is in the Operating Mode IAW OP-TM-232-000, "Liquid Waste Disposal System." ___

3.3.2 **VERIFY** the Decay Heat Removal System is in any Mode IAW OP-TM-212-000, "Decay Heat Removal System." ___

3.3.3 **VERIFY** **no** conflicting cleanup processes in progress in SF/WDL systems. ___

3.3.4 **VERIFY** BWST liquid temperature on DH4-TI (CC) is less than 120°F. ___

## 4.0 MAIN BODY

4.1 **IDENTIFY** one Precoat Filter to be used for the cleanup process. ___

"A" Precoat Filter _____

"B" Precoat Filter _____

4.2 **If** required for the cleanup process, **then IDENTIFY** Cation Demineralizer(s) to be used for the cleanup process. ___

"A" Cation Demineralizer _____

"B" Cation Demineralizer _____

4.3 **RECORD** the required cleanup flowrate: ___

| Flow Rate |
|---|
| gpm |

4.4 **RECORD** initial BWST level, and PPC point used to determine level. ___

| Initial BWST Level | PPC Point Used (Circle) | |
|---|---|---|
| | A0486 | A0487 |

4.5 **VERIFY** SF-P-1A Mode Switch is **not** in the FILL FUEL TRANS CANAL position **or** the DRAIN FUEL TRANS CANAL position. ___

4.6 **VERIFY** SF-P-1B Mode Switch is **not** in the FILL FUEL TRANS CANAL position **or** the DRAIN FUEL TRANS CANAL position. ___

4.7 **If** SF-P-1A is **not** running, **then VERIFY** SF-P-1A is in PULL TO LOCK. ___

4.8 **If** SF-P-1B is **not** running, **then VERIFY** SF-P-1B is in PULL TO LOCK. ___

4.9 **If** PPC is available, **then PLACE** PPC point A0486 or A0487 on trend to monitor for BWST level changes. ___

4.10 **If** PPC is **not** available, **then MONITOR** DH-LI-808A or DH-LI-809A for BWST level changes. ___

4.11 **VERIFY** the following valves are Closed: ___

– SF-V-37 ___

– SF-V-35 ___

– SF-V-21 ___

– SF-V-18 ___

– SF-V-41 ___

– SF-V-42 ___

– SF-V-49 ___

– SF-V-44 ___

– SF-V-46 ___

– SF-V-47 ___

4.12 **OPEN** the following valves: ___

– SF-V-19 ___

– SF-V-20 ___

– SF-V-36 ___

– SF-V-43 ___

– SF-V-45 ___

– DH-V-28 ___

4.13 **If** cleanup process is through “A” precoat filter only, **then OPEN** the following valves: ___

– WDL-V-63 ___

– WDL-V-68 ___

4.14 **If** cleanup process is through “B” precoat filter only, **then OPEN** the following valves: ___

– WDL-V-64 ___

– WDL-V-69 ___

4.15 **If** cleanup process is through “A” precoat filter and “A” Cation Demineralizer, **then OPEN** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-70 ___

4.16 **If** cleanup process is through “A” precoat filter and “B” Cation Demineralizer, **then OPEN** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-67 ___

– WDL-V-71 ___

4.17 **If** cleanup process is through “A” precoat filter and <u>both</u> Cation Demineralizers, **then OPEN** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-67 ___

– WDL-V-70 ___

– WDL-V-71 ___

4.18 **If** cleanup process is through “B” precoat filter and “B” Cation Demineralizer, **then OPEN** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-71 ___

4.19 **If** cleanup process is through "B" precoat filter and "A" Cation Demineralizer, **then OPEN** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-67 ___

– WDL-V-70 ___

4.20 **If** cleanup process is through "B" precoat filter and <u>both</u> Cation Demineralizers, **then OPEN** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-67 ___

– WDL-V-70 ___

– WDL-V-71 ___

4.21 **THROTTLE OPEN** SF-V-40 to between 1 and 1 ½ turns open. ___

4.22 **START** SF-P-2. ___

4.23 Perform the following to initiate cleanup process:

1. **RECORD** Precoat Filter to be used for BWST cleanup: ___

   ___ "A" Precoat Filter ___ "B" Precoat Filter

2. **PRESS and HOLD** the INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel for the Precoat Filter being used for BWST cleanup. ___

3. **When** <u>either</u> of the following conditions occur, **then RELEASE** the INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel: ___

   – Greater than 60 gpm flow is indicated on WDL-FR-126. ___

   – The INITIATE PROCESS FLOW pushbutton on the Precoat Filter panel has been depressed for 10 seconds. ___

4. **RECORD** process start date **and** time. ___

| Start Date | Start Time |
|---|---|
| | |

4.24 **If** no flow is indicated on WDL-FR-126, **then** perform the following: ___

1. **THROTTLE OPEN** SF-V-40 as required to obtain greater than 60 gpm flow when cleanup process is initiated. ___
2. **GO TO** Step 4.23. ___

4.25 **IAAT** any of the following limits are approached:

– 150 gpm through one Precoat Filter on WDL-FR-126
– 140 gpm through both Cation Demineralizers on WDL-FR-126
– 70 gpm through one Cation Demineralizer on WDL-FR-126
– 20 psid on WDL-DPI-343 (WDL-F-1A) **or** WDL-DPI-344 (WDL-F-1B)
– 35 psid on WDL-DPI-348 (WDL-K-2A) **or** WDL-DPI-349 (WDL-K-2B)
– 28 psid on WDL-DPI-350 (WDL-F-3A) **or** WDL-DPI-351 (WDL-F-3B)

**or** cleanup flow is **not** at desired flow rate,

**then THROTTLE** SF-V-40 as required to maintain flow as close as possible to the desired flow rate while maintaining flow and differential pressure within limits. ☐

4.26 **If** "A" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___

1. **PLACE** CA-P-5A control switch in Auto. ___
2. **PLACE** CA-V-145A control switch in Auto. ___
3. **PLACE** CA-V-202A control switch in Auto. ___

4.27 **If** "B" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___

1. **PLACE** CA-P-5B control switch in Auto. ___
2. **PLACE** CA-V-145B control switch in Auto. ___
3. **PLACE** CA-V-202B control switch in Auto. ___

4.28 **IAAT** any of the following occur:

- BWST level is **not** stable
- Flow is lowered to less than or equal to 60 gpm to maintain differential pressure within limits
- Precoat Filter trips into Hold mode when lowering flow to maintain differential pressure within limits
- Shift Management directs termination of transfer

**then GO TO** Step 5.1. ☐

## 5.0 RETURN TO NORMAL

5.1 **When** termination of BWST recirculation and cleanup is required, **then CONTINUE.** ___

5.2 **If** Precoat Filter is **not** in Hold mode, **then** perform the following: ___

1. **ESTABLISH** communications between Precoat Panel operator and operator at SF-V-40. ___
2. **THROTTLE CLOSED** SF-V-40 as required to obtain 60 gpm indicated on WDL-FR-126. ___

5.3 Perform the following to manually place the Precoat Filter on hold:

1. **If** "A" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___
   A. **PLACE** CA-V-202A control switch in Open. ___
   B. **PLACE** CA-V-145A control switch in Open. ___
   C. **PLACE** CA-P-5A control switch in On. ___
2. **If** "B" Precoat Filter is being used for BWST cleanup, **then** perform the following: ___
   A. **PLACE** CA-V-202B control switch in Open. ___
   B. **PLACE** CA-V-145B control switch in Open. ___
   C. **PLACE** CA-P-5B control switch in On. ___

5.4 **PLACE** SF-P-2 control switch in Normal After Stop. ___

5.5 **RECORD** process stop date **and** time. ___

| Stop Date | Stop Time |
|---|---|
| | |

5.6 **If** cleanup process was through "A" Precoat Filter only, **then CLOSE** the following valves: ___

– WDL-V-63 ___

– WDL-V-68 ___

5.7 **If** cleanup process was through “B” Precoat Filter only, **then CLOSE** the following valves: ___

– WDL-V-64 ___

– WDL-V-69 ___

5.8 **If** cleanup process was through “A” precoat filter and “A” Cation Demineralizer, **then CLOSE** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-70 ___

5.9 **If** cleanup process was through “A” precoat filter and “B” Cation Demineralizer, **then CLOSE** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-67 ___

– WDL-V-71 ___

5.10 **If** cleanup process was through “A” precoat filter and <u>both</u> Cation Demineralizers, **then CLOSE** the following valves: ___

– WDL-V-63 ___

– WDL-V-65 ___

– WDL-V-67 ___

– WDL-V-70 ___

– WDL-V-71 ___

5.11 **If** cleanup process was through “B” precoat filter and “B” Cation Demineralizer, **then CLOSE** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-71 ___

5.12 **If** cleanup process was through “B” precoat filter and “A” Cation Demineralizer, **then CLOSE** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-67 ___

– WDL-V-70 ___

5.13 **If** cleanup process was through “B” precoat filter and <u>both</u> Cation Demineralizers, **then CLOSE** the following valves: ___

– WDL-V-64 ___

– WDL-V-66 ___

– WDL-V-67 ___

– WDL-V-70 ___

– WDL-V-71 ___

5.14 **CLOSE** the following valves: ___

– DH-V-28 ___

– SF-V-40 ___

– SF-V-43 ___

– SF-V-45 ___

NOTE: Performance of the following steps in order will ensure a vent path exists and prevent hydraulic locking of large diaphragm operated valves such as SF-V-20.

5.15 **CLOSE** SF-V-19. ___

5.16 **OPEN** SF-V-42. ___

5.17 **CLOSE** SF-V-20. ___

5.18 **CLOSE** SF-V-36. ___

5.19 **CLOSE** SF-V-42. ___

NOTE: The same PPC point that was used to determine initial BWST level should be used in the following step.

5.20 **RECORD** final BWST level, and PPC point used to determine level. ___

| Final BWST Level | PPC Point Used (Circle) |
|---|---|
| | A0486 A0487 |

5.21 **CALCULATE** BWST level change by subtracting Final BWST Level from Initial BWST Level. ___

_____ - _____ = _____
Initial BWST Level Final BWST Level BWST Level Change

5.22 **If** the absolute value of BWST Level Change is greater than 0.1 feet, **then** perform the following: ___

1. **VERIFY** TS 3.3.1.1.a (BWST volume) **and** TS 3.3.1.3.b (NaOH Tank / BWST differential level) requirements continue to be met. ___
2. **INITIATE** an IR to investigate cause of BWST level change. ___

## 6.0 REFERENCES

6.1 1104-29C, Spent Fuel Cleanup Processes, Rev. 32 Section 5.0

## 7.0 ATTACHMENTS

7.1 Device Locator List

**ATTACHMENT 7.1**
**Device Locator List**
Page 1 of 2

| DEVICE | DESCRIPTION | ELEV | BLDG | AREA |
|---|---|---|---|---|
| CA-P-5A-EX4 | CA-P-5A LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-P-5B-EX4 | CA-P-5B LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-145A-EX4 | CA-V-145A LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-145B-EX4 | CA-V-145B LOCAL CONTROL | 305 | AB | Precoat Panel |
| CA-V-202A-EX7 | CA-V-202A CONTROL SWITCH | 305 | AB | Precoat Panel |
| CA-V-202B-EX7 | CA-V-202B CONTROL SWITCH | 305 | AB | Precoat Panel |
| DH-V-28 | BWST Cleanup Return From SF Cooling | 305 | Yard | 1’ East of BWST, 4’ South of 24” Discharge Line |
| SF-P-2-EX7 | SF-P-2 Pistol Grip Ctl Sw (NSP,NST,PTL) | 305 | AB | Radwaste Panel |
| SF-V-18 | SF Pumps Suct Isolation Vlv From BWST | 281 | AB | North of Elevator, West Wall |
| SF-V-19 | SF-DHR X-Conn Isol Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-20 | SF Syst To BWST Isolation Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-21 | SF/FTC Isol Valve | 281 | AB | North of Elevator, West Wall |
| SF-V-35 | SF-P2 Suct Vlv From Spent Fuel Cask Pit | 281 | AB | North of Elevator, West Wall |
| SF-V-36 | SF-P2 Suct Vlv From BWST Tank | 281 | AB | North of Elevator, West Wall |
| SF-V-37 | SF-P2 Suct Vlv From Fuel Pool A & B | 281 | AB | North of Elevator, West Wall |
| SF-V-41 | SF-P-2 Disch Isol Vlv To A SF Pool | 281 | AB | North of Elevator, West Wall |
| SF-V-42 | SF-P-2 Disch Isol Vlv To SF Fuel Cask Pit | 281 | AB | North of Elevator, West Wall |
| SF-V-43 | LWDS To Spent Fuel Syst Isol Valve | 281 | AB | North of Elevator, East Wall |
| SF-V-44 | SF System Isol Valve To DH-P-1A Suct | 281 | AB | North of Elevator, East Wall |
| SF-V-45 | SF System Isolation Valve To BWST | 281 | AB | North of Elevator, East Wall |

**ATTACHMENT 7.1**
**Device Locator List**
Page 2 of 2

| DEVICE | DESCRIPTION | ELEV | BLDG | AREA |
|---|---|---|---|---|
| SF-V-46 | LWDS Purif Line To A Spent Fuel Pool | 281 | AB | North of Elevator, East Wall |
| SF-V-47 | LWDS Purif Line To B Spent Fuel Pool | 281 | AB | North of Elevator, East Wall |
| SF-V-49 | SF-P-2 Priming Line Isol Vlv | 281 | AB | North of Elevator, West Wall |
| WDL-FR-126 | PRECOAT FILTER A/B INLET FLOW RECORDER | 305 | AB | Precoat Panel |
| WDL-V-63-EX7 | WDL-V-63 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-64-EX7 | WDL-V-64 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-65-EX7 | WDL-V-65 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-66-EX7 | WDL-V-66 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-67-EX7 | WDL-V-67 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-68-EX7 | WDL-V-68 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-69-EX7 | WDL-V-69 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-70-EX7 | WDL-V-70 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |
| WDL-V-71-EX7 | WDL-V-71 Control Pushbutton (Open/Closed) | 305 | AB | Radwaste Panel |

**ATTACHMENT 6**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

**PROPOSED MARKED-UP PROCEDURE OP-TM-AOP-003, "EARTHQUAKE"**

# EARTHQUAKE

## 1.0 ENTRY CONDITIONS

Any of the following:

– Yellow EVENT indicator Lit on front panel of Strong Motion Accelerometer System (CR).

– PRF-1-2, “Threshold Seismic Condition” actuated.

– Red OBE indicator Lit on front panel of Strong Motion Accelerometer System (CR).

– PRF-1-3, “Operating Basis Earthquake” actuated.

– Ground motion felt by station personnel.

## 2.0 IMMEDIATE ACTIONS

None

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## 3.0 FOLLOW-UP ACTIONS

| ACTION/EXPECTED RESPONSE | RESPONSE NOT OBTAINED |
|---|---|
| ___ 3.1 **ANNOUNCE** entry into OP-TM-AOP-003, "Earthquake," over the plant page **and** radio. | |
| ☐ 3.2 **IAAT** an Operating Basis Earthquake (OBE) has occurred **or** plant damage levels warrant a plant shutdown, **then** perform the following:<br>___ 1. **INITIATE** a plant shutdown IAW 1102-4, "Power Operation" **and** 1102-10, "Plant Shutdown".<br>___ 2. **INITIATE** 1102-11, "Plant Cooldown". | ___ 1. **TRIP** the reactor **and INITIATE** EOP-001. |
| ___ 3.3 **EVALUATE** Emergency Action Levels (EALs). | |
| 3.4 **If** BWST is on Clean up IAW OP-TM-212-501 or Recirc IAW OP-TM-212-252 Section 4.2, **then PERFORM** the following:<br>___ 1. **STOP** SF-P-2<br>___ 2. **CLOSE** SF-V-43<br>___ 3. **CLOSE** SF-V-40<br>___ 4. **CLOSE** SF-V-20<br>___ 5. **CLOSE** SF-V-45 | |
| ☐ 3.5 **IAAT** an event at **or** above the Threshold Seismic Condition (TSC) has occurred, **GO TO** Step 3.8. | |

| **CARRY-OVER STEPS** | |
|---|---|
| **Condition** | **Step** |
| An OBE has occurred **or** plant damage levels warrant a shutdown | 3.2 |
| An event at **or** above the Threshold Seismic Condition (TSC) has occurred | 3.5 |

| ACTION/EXPECTED RESPONSE | RESPONSE NOT OBTAINED |
|---|---|
| ___ 3.6 **If** <u>both</u> of the following conditions exist**:**<br><br>– Seismic instrumentation is inoperable **or** does **<u>not</u>** indicate a seismic event.<br><br>– A seismic event is felt by on-site personnel.<br><br>**then PERFORM** Attachment 1, Seismic Instrumentation Inoperable. | |
| ___ 3.7 **If** <u>either</u> of the following conditions exist: | |

**<u>NOTE</u>**

Following an Operating Basis Earthquake (OBE), the OBE indicator and PRF-1-3 will **<u>not</u>** actuate until recording is complete (possibly several minutes after the event).

| | |
|---|---|
| – EVENT **or** OBE indicator Lit on seismic instrumentation.<br><br>– PRF-1-2 **or** PRF-1-3 Actuated.<br><br>**then PERFORM** Attachment 2, Determining Validity of Seismic Instrumentation/Alarms. | |
| ___ 3.8 **If** a TSC **or** OBE has been declared, **then PERFORM** Attachment 3, Actions for a Valid Seismic Condition. | |
| ___ 3.9 **GO TO** Section 4.0, “Return To Normal”. | |

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## 4.0 RETURN TO NORMAL

NOTE: The following steps may be performed in any order or concurrently.

1. **If** the earthquake magnitude was determined to be less than a Threshold Seismic Condition, **then NOTIFY** the PDMS Manager that no response is required. ___

2. **If** the Technical Support Center (TSC) was activated, **then OBTAIN** recovery directions from the TSC. ___

3. **If** an earthquake was determine to have occurred, **then NOTIFY** I&C to perform the following Appendices of 1105-17, Earthquake Monitoring System: ___

   – Appendix 1, Backup Of Recorded Events ___

   – Appendix 2, Retrieval and Processing of PRA Erasure Tape ___

4. **If** the seismic event exceeded the OBE criteria, **then** perform the following prior to plant restart (based on the results of the restart walkdown required by Step 4.15.2 of Attachment 3): ___

   – **OBTAIN** concurrence from the Plant Manager. ___

   – **OBTAIN** permission from the NRC. ___

5. Perform the following to reset TSC and OBE alarms:

   1. **PRESS** RESET on the Strong Motion Accelerometer System (CR). ___

   2. **ENSURE** PRF-1-2 and PRF-1-3 are clear. ___

## 5.0 ATTACHMENTS

Attachment 1, Seismic Instrumentation Inoperable

Attachment 2, Determining Validity of Seismic Instrumentation/Alarms

Attachment 3, Actions for a Valid Seismic Condition

Attachment 4, Criteria For SSE Exceedance

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**ATTACHMENT 1**
**Seismic Instrumentation Inoperable**
Page 1 of 3

## 1.0 PURPOSE

To confirm and classify a seismic event in the absence of installed seismic instrumentation/alarms.

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

3.1 Precautions:

None

3.2 Limitations:

None

3.3 Prerequisites:

None

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**ATTACHMENT 1**
**Seismic Instrumentation Inoperable**
Page 2 of 3

## 4.0 MAIN BODY

4.1 **CONTACT** the U.S. Geological Survey's National Earthquake Center (USGS) to confirm the earthquake (303-273-8500). ___

4.2 **If** the earthquake is confirmed, **then** perform the following: ___

1. **RECORD** the following from the Earthquake Center:

   – Epicenter Location: _____
   (latitude & longitude)

   _____
   (nearest town & state)

   – Magnitude: _____ (Richter scale)

2. **If** it is determined that a nearby nuclear site is closer to the epicenter, **then** perform the following: ___

   A. **CONTACT** that facility (using an applicable phone number below), **and OBTAIN** the seismic data from their instrumentation. ___

| **Facility** | **Phone numbers (Ops Support Mgr / SM / CRS)** |
|---|---|
| Peach Bottom | (717) 456-3477 / 4687 / 4223 |
| Limerick | (610) 718-2840 / 2128 / 2125 |
| Salem – Hope Creek | (856) 339-2636 / 5200 / 5201 (5202) |
| Susquehanna | (570) 542-3907 / 1971 / 3903 |
| Beaver Valley | (724) 682-5198 / 5302 (5102) / 5110 (5313) |

   B. **USE** the alternate site's seismic data (if available) to determine **and** declare the earthquake classification (OBE or TSC). ___

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**ATTACHMENT 1**
**Seismic Instrumentation Inoperable**
Page 3 of 3

4.2 (Continued)

3. **If** data from a closer nearby site can **not** be used, **then** perform the following: ___

   A. **If** the earthquake had a magnitude ≥ 6.0 (Richter Scale), **then DECLARE** an OPERATING BASIS EARTHQUAKE (OBE) has occurred. ___

   B. **If** the earthquake was ≥ 5.0 but < 6.0 (Richter Scale), **then** perform the following: ___

   NOTE: If required, TMI's location, (40° 9' 14.17"N, 76° 43' 30.69"W), can be used to determine the distance to the earthquake epicenter. This can be performed by the USGS Earthquake Center staff or by using internet web sites (such as Google Earth).

   1) **DETERMINE** the distance from TMI to the epicenter (using any available means). ___

   2) **If** the earthquake was within 125 miles of TMI, **then DECLARE** an OPERATING BASIS EARTHQUAKE (OBE) has occurred. ___

4. **If** data from a closer nearby site can **not** be used **and** an OBE has **not** occurred, **then DECLARE** a THRESHOLD SEISMIC CONDITION (TSC) has occurred. ___

## 5.0 RETURN TO NORMAL

None

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**ATTACHMENT 2**
**Determining Validity of Seismic Instrumentation/Alarms**
Page 1 of 4

## 1.0 PURPOSE

To determine the validity of a seismic instrument alarm.

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

3.1 Precautions:

None

3.2 Limitations:

None

3.3 Prerequisites:

None

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**ATTACHMENT 2**
**Determining Validity of Seismic Instrumentation/Alarms**


## 4.0 MAIN BODY

NOTE: The steps of this section may be performed in any order or concurrently.

4.1 **EVALUATE** Seismic Monitor computer printouts using Figures 1 **and** 2 of this Attachment. ___

4.2 **If** the Control Room staff did **not** feel ground motion, **then CONTACT** Security **or** other station personnel for reports of ground motion. ___

4.3 **CONTACT** one of the following for an independent confirmation of earthquake intensity:

– Peach Bottom Atomic Power Station (717-456-4687/4221) ___

– Limerick Generating Station (610-718-2125) ___

– National Earthquake Center (303-273-8500) ___

4.4 **If** the seismic monitor printouts indicate an OBE has occurred **and** the earthquake is confirmed by either of the following:

– Felt by station personnel,

– Independently confirmed by any of the facilities in Step 4.3 above,

**then DECLARE** an OPERATING BASIS EARTHQUAKE (OBE) has occurred. ___

4.5 **If** the seismic monitor printouts indicate an OBE has **not** occurred **but** the earthquake is confirmed by either of the following:

– Felt by station personnel

– Independently confirmed by any of the facilities in Step 4.3 above

**then DECLARE** a THRESHOLD SEISMIC CONDITION (TSC) has occurred. ___

## 5.0 RETURN TO NORMAL

None

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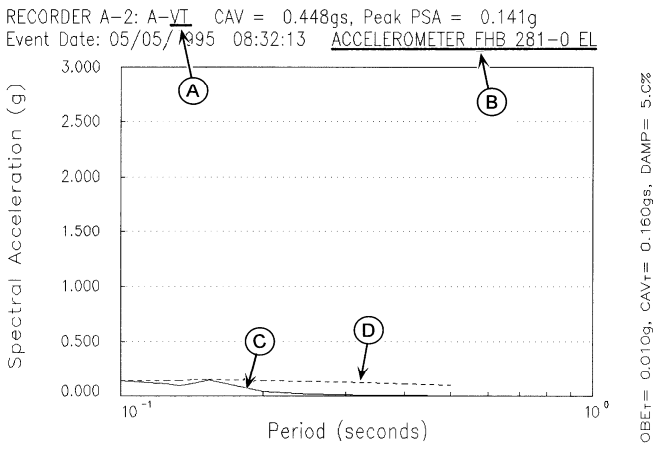
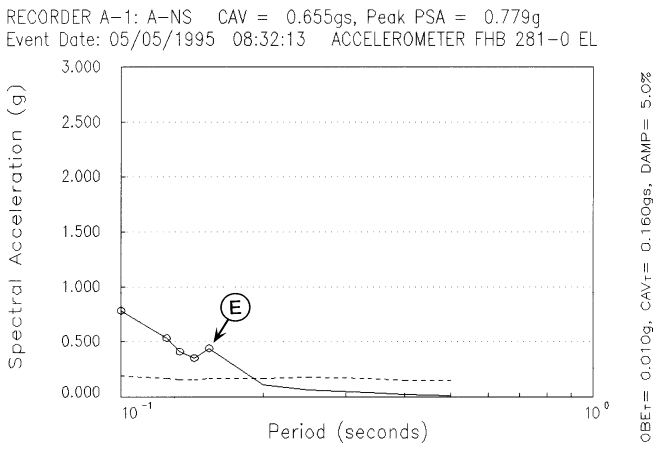
# ATTACHMENT 2
## Determining Validity of Seismic Instrumentation/Alarms
Page 3 of 4

### FIGURE 1
### Typical Seismic Event Printout

**EXAMPLE OF OBE NOT EXCEEDED PLOT**




**EXAMPLE OF OBE AND SSE EXCEEDED PLOT**




(A) Direction of motion. VT=vertical NS=north-south EW=east-west
(B) Accelerometer location.
(C) Plot of seismic event.
(D) OBE setpoint line.
(E) Circles indicate where OBE setpoint line was exceeded.

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# ATTACHMENT 2
## Determining Validity of Seismic Instrumentation/Alarms
Page 4 of 4

**FIGURE 2**

**NOTE**

1. There will be two separate printouts of this chart, one for each triaxial accelerometer.
2. An alarm is VALID if two or more channels have at least one measurement exceeding 0.010g.
3. An alarm is potentially VALID if one channel has a measured value of ≥ 0.010g, and any other channel has measurements approaching 0.010g.
4. If only one channel shows any significant measurements, (as in the example below), the alarm is **not** VALID and is likely due to induced electrical noise.
5. OBE criteria is: At least one measurement in any frequency in any channel exceeds design, and at least 1 measurement in any other frequency in any other channel exceeds 2/3 design.

RESPONSE SPECTRA ANALYSIS FOR SSA-3 RECORDER B (S/N 31272)
EVENT DATE: 04/11/1999 16:29:51 ACCELEROMETER RB 455-8 EL
SELECTED EXCEEDANCE CRITERIA: NONE

**CHANNEL 1: B-NS**
Computed CAV = 0.000 g - s, CAV Design Limit = 0.160 g – s, OBE Limit Value = 0.010 g, Damping = 0.050
Spectral acceleration exceeded OBE design criteria at 0 periods
Spectral acceleration greater than 2/3 OBE design criteria at 0 periods

**CHANNEL 2: B-VT**
Computed CAV = 0.001 g - s, CAV Design Limit = 0.160 g – s, OBE Limit Value = 0.010 g, Damping = 0.050
Spectral acceleration exceeded OBE design criteria at 0 periods
Spectral acceleration greater than 2/3 OBE design criteria at 0 periods

**CHANNEL 3: B-EW**
Computed CAV - 0.000 g - s, CAV Design Limit = 0.160 g – s, OBE Limit Value = 0.010 g, Damping = 0.050
Spectral acceleration exceeded OBE design criteria at 0 periods
Spectral acceleration greater than 2/3 OBE design criteria at 0 periods

**** OBE CRITERIA WAS NOT EXCEEDED ****

| **OBE Design Values vs. Measured OBE Values (Units = g)<br>*indicates OBE design exceeded, + indicates > 2/3 OBE design value** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Period** | **Channel 1** | | **Channel 2** | | **Channel 3** | | **Channel 4** |
| **[sec]** | **Design** | **Meas.** | **Design** | **Meas.** | **Design** | **Meas.** | **Unused** |
| 0.100 | 0.250 | 0.001 | 0.260 | 0.040 | 0.270 | 0.004 | |
| 0.125 | 0.350 | 0.001 | 0.200 | 0.032 | 0.360 | 0.001 | |
| 0.133 | 0.380 | 0.001 | 0.190 | 0.030 | 0.380 | 0.001 | |
| 0.143 | 0.400 | 0.001 | 0.190 | 0.029 | 0.420 | 0.001 | |
| 0.154 | 0.400 | 0.001 | 0.180 | 0.027 | 0.480 | 0.001 | |
| 0.200 | 1.060 | 0.001 | 0.160 | 0.020 | 1.190 | 0.001 | |
| 0.250 | 1.130 | 0.001 | 0.130 | 0.016 | 1.160 | 0.001 | |
| 0.333 | 0.600 | 0.000 | 0.120 | 0.012 | 0.530 | 0.000 | |
| 0.400 | 0.370 | 0.000 | 0.120 | 0.010 | 0.350 | 0.000 | |
| 0.500 | 0.250 | 0.000 | 0.100 | 0.008 | 0.230 | 0.000 | |

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**ATTACHMENT 3**
**Actions for a Valid Seismic Condition**
Page 1 of 3

## 1.0 PURPOSE

To provide the actions required to respond to a valid seismic condition.

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

3.1 Precautions:

None

3.2 Limitations:

None

3.3 Prerequisites:

None

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**ATTACHMENT 3**
**Actions for a Valid Seismic Condition**
Page 2 of 3

## 4.0 MAIN BODY

4.1 **VERIFY** performance of this procedure has resulted in the declaration of an Operating Basis Earthquake (OBE) **or** a Threshold Seismic Condition (TSC). ___

NOTE: The remaining Steps of this section may be performed in any order or concurrently.

4.2 **If** the earthquake **or** plant damage was severe enough to have potentially caused unreported personnel injury, **then** perform either **or** both of the following: ___

– **DISPATCH** Security **and** other available personnel to search for victims. ___

– **PERFORM** personnel assembly/accountability. ___

4.3 **INITIATE** OP-TM-108-111-1001, "TMI Severe Weather and Site Inaccessibility Guidelines." ___

4.4 **INITIATE** OP-AA-108-111-1001, "Severe Weather and Natural Disaster Guidelines." ___

NOTE: The intent of Step 4.5 is to determine the effects of the earthquake on SSCs. This information is needed to determine if the plant can continue to operate or should be shutdown for additional inspections.

4.5 **If** the plant is in operation, **then INITIATE** a visual inspection of all accessible areas of the plant IAW EPRI NP-6695, "Guidelines for Nuclear Power Plant Earthquake Response." ___

4.6 **NOTIFY** the PDMS Manager to perform the following:

– Inspect TMI-2 for damage. ___

– Initiate 2301-1.1, "TMI-2 Reactor Vessel Fuel Removal/Rearrangement". ___

4.7 **ENSURE** the BWST is **not** on cleanup IAW OP-TM-212-501 "Cleanup of the BWST" or Recirc IAW OP-TM-212-252 Section 4.2 ___

4.8 **ENSURE no** releases in progress. ___

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**ATTACHMENT 3**
**Actions for a Valid Seismic Condition**
Page 3 of 3

4.9 **If** any of the following:
- Spent Fuel Pool Temperature (A0419 **or** A0420) is >160°F
- Spent Fuel Pool Level is < 343'6" (PLB-2-9 **or** PLB-2-10 in alarm)
- Spent Fuel Pool Temperature and/or level is unknown,

**then INITIATE** OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling. ___

4.10 **If** there is steam leakage in the Auxiliary Building, **then ENSURE** the following are Closed: ___
- AS-V-17 (TB 355: W of 8B heater 7 ft up). ___
- EX-V-23 (TB 355: S end of AB steam header). ___

4.11 **If** ISPH ventilation is lost, **then INITIATE** OP-TM-535-901, "Emergency Ventilation of Screen House". ___

4.12 **If** DG Building ventilation is lost, **then INITIATE** the following for the affected building: ___
- OP-TM-861-910, "Emergency Ventilation of EG-Y-1A Room" ___
- OP-TM-861-911, "Emergency Ventilation of EG-Y-1B Room" ___

4.13 **If** Control Building ventilation is lost, **then INITIATE** OP-TM-AOP-034, "Loss of Control Building Cooling". ___

4.14 **If** EFW Pump Room ventilation is degraded, **then EVALUATE** the recommendations of SA-AA-111, "Heat Stress Control". ___

4.15 **If** OBE limits have been exceeded, **then** perform the following: ___

1. **INITIATE** inspection of the Spent Fuel Pool "A" racks to verify rack-to-rack **and** rack-to-wall gaps are maintained. ___
2. **When** the plant is shutdown, **then** perform the following: ___
   - **INITIATE** the post-shutdown plant inspections and tests IAW EPRI NP-6695, "Guidelines for Nuclear Power Plant Earthquake Response." ___
   - **INITIATE** OTSG inspection per EP-AP-420-003, "TMI Unit 1: Steam Generator Eddy Current Activities." ___
3. **DETERMINE** if the SSE criteria was exceeded using Attachment 4. ___

## 5.0 RETURN TO NORMAL

None

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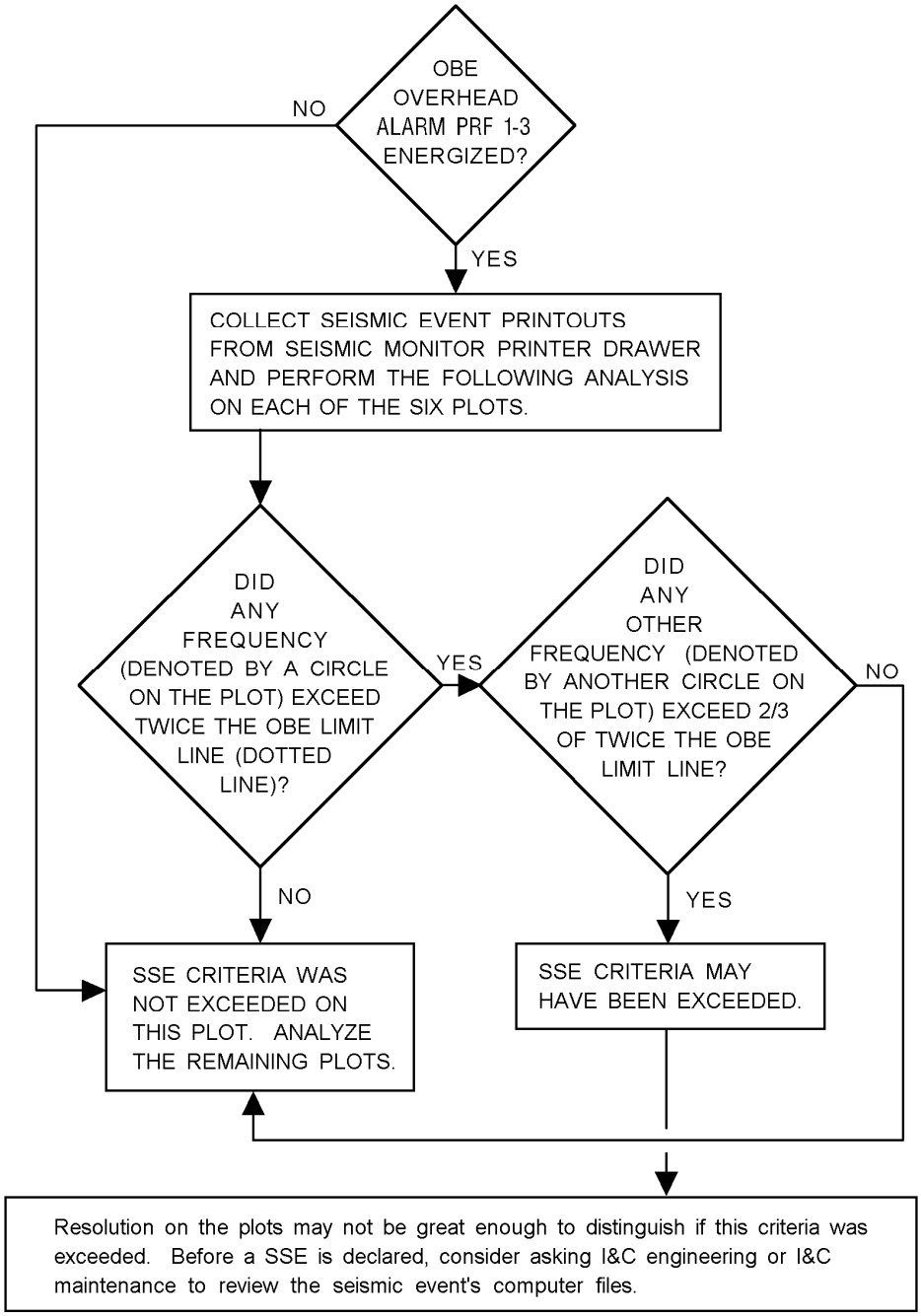
**ATTACHMENT 4**
**Criteria for SSE Exceedance**
Page 1 of 1



**ATTACHMENT 7**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

# PROPOSED MARKED-UP PROCEDURE OP-TM-AOP-0031, "EARTHQUAKE BASIS DOCUMENT"

# EARTHQUAKE BASIS DOCUMENT

## 1.0 DESIGN OR LICENSING BASIS REQUIREMENTS

1.1 UFSAR:

1.1.1 Section 2.8.1 states:

*The conservative estimate of the maximum earthquake intensity to be expected at the site is a low intensity VI. Using relationships published in Reference 2.1, this intensity corresponds to a ground acceleration of 0.04g. The design is conservatively based on a basic ground motion of 0.06g.*

1.1.2 Section 5.1.2.1 describes the design bases for Class I, II, and III structures, systems, and components (SSC), and includes the following definitions of the Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE):

OBE: *ground acceleration of 0.06g acting horizontally and 0.04g acting vertically and occurring simultaneously*

SSE: *ground acceleration of 0.12g acting horizontally and 0.08g acting vertically and occurring simultaneously*

1.1.3 Section 5.1.2.1.1.b states that a Class I design ensures that the stress resulting from an SSE *"has been limited so that the function of the structure is not impaired as to prevent a safe and orderly shutdown of the plant."*

1.1.4 Section 5.1.2.1.2.b states that a Class I design ensures that the stresses resulting from an SSE *"have been limited so that the function of the component, system, or structure is not impaired as to prevent a safe and orderly shutdown of the plant."*

1.1.5 Table 5.4.1 provides a listing of the Class I structures, systems, and components at TMI.

1.2 FHAR:

None

1.3 Technical Specifications:

1.3.1 Unit 2 Technical Specifications:

*3.2.1.2 No more than 42 kg of fuel in the Reactor Vessel may be rearranged outside the geometry's analyzed in the Defueling Completion Report and the criticality safety analyses contained in GPU Nuclear letter C312-92-2080, dated December 18, 1992, without prior NRC approval.*

1.3.2 Unit 1 Technical Specifications:

While there are numerous technical specifications that could potentially be affected due to damage sustained from an earthquake, there are no Unit 1 Technical Specifications directly relevant to seismic events or instrumentation or this procedure.

1.4 Critical Safety Function Review

1.4.1 CSF 1, Reactivity & Reactor Power Control: Maintain control of the fission process, maintain the capability to shutdown the reactor and the capability to maintain the reactor in a shutdown condition. Control energy production and reactor power distribution based on design limits and current core heat removal capability.

EARTHQUAKE: For all earthquakes at or below the Safe Shutdown Earthquake (SSE), all systems designed Class I (including those required for Reactivity and Reactor Power Control), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.2 CSF 2, Reactor Vessel Inventory Control: Provide the means to maintain the core covered with sub cooled water.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Reactor Vessel Inventory Control), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.3 CSF 3, RCS Integrity: Maintain the capability to control heatup and cooldown rates and control RCS pressure prevent reactor vessel brittle fracture or LTOP events. Maintain RCP seal cooling to prevent excessive loss of RCS inventory through RCP seals.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for RCS Integrity), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.4 CSF 4, Core Heat Removal: Provide the capability to remove core heat production at all times.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Core Heat Removal), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.5 CSF 5, Containment Integrity: Provide means to prevent or minimize fission product release to the environment. (1) Maintain containment pressure below design and (2) Provide capability to isolate the containment when required.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Containment Integrity), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.6 CSF 6, Radiation Control & Control Room Habitability: Monitor and control the release of radiation to the environment. Maintain access to critical plant equipment and use of the Control Room.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Radiation Control & Control Room Habitability), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.7 CSF 7, Electrical Power: Provide electrical power as required to accomplish the other Critical Safety Functions. Provide AC and DC power for emergency equipment operation and instrumentation systems.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Electric Power), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.8 CSF 8, Auxiliary Emergency Systems: Provide equipment cooling (closed cooling & ventilation), and other support requirements to accomplish the other Critical Safety Functions. Provide Instrument Air for operation of EFW, ADVs, RCP Support Systems and some containment isolation valves.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Auxiliary Emergency Systems), remain operable. Earthquakes above the SSE are outside design basis events.

1.4.9 CSF 9, Fire Protection & Remote Shutdown Capability: Maintain means to prevent, detect and suppress fires, as well as the capability to perform a plant shutdown without access to the Control Room.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I (including those required for Remote Shutdown Capability), remain operable. Per A.4 and A.5 of Section 5.0 of the FHAR, TMI complies with the requirements that: 1) a single failure in the fire suppression system should not impair both the primary and backup fire suppression capability, and 2) failure of the fire suppression system should not incapacitate safety related systems or components. Earthquakes above the SSE are outside design basis events.

1.4.10 CSF 10, Chemistry Control: Provide the means to monitor and control primary and secondary water chemistry in order to ensure the long term reliability of plant systems and limit the potential release of radioactive materials.

EARTHQUAKE: For all earthquakes at or below the SSE, all systems designed Class I remain operable. The ability to operate non-seismic systems (such as primary and secondary sampling) may be lost. However, pressure boundaries of sample systems within the containment will remain intact. Earthquakes above the SSE are outside design basis events.

## 2.0 MITIGATION STRATEGY

Paragraph (V)(a)(2) of 10CFR100, Appendix A, Seismic And Geologic Siting Criteria For Nuclear Power Plants, requires that a nuclear power plant be shut down and inspected if an earthquake motion occurs at the site which exceeds the Operating Basis Earthquake (OBE). The principal concern associated with exceeding the OBE is potential damage which could preclude continued safe operation.

Per EPRI NP-6695, Guidelines for Nuclear Plant Response to an Earthquake, the objectives of an earthquake response are to:

1. Determine the immediate effects of an earthquake on the physical condition of the plant.

2. Determine if shutdown is appropriate based on the observed damage to the plant or because the OBE has been exceeded.

3. Determine the readiness of the plant to resume operation, if shutdown.

Since earthquake damage can range anywhere from none (or insignificant), to catastrophic, this procedure is designed to work in conjunction with the remainder of the EOP/AOP network to accomplish objectives 1 and sometimes 2 above. (i.e., Damage from a seismic event may result in plant symptoms - up to and including a plant trip - that require concurrent entry into appropriate abnormal/emergency procedure(s). For these cases, performance of the appropriate abnormal/emergency procedure(s) will resolve the situation(s) resulting from the damage that occurred. Absence of such damage-induced symptoms indicates less sustained or immediate damage, thus reducing the urgency of the response and allowing time for this AOP to carry out walkdown inspections to determine the extent of the damage.)

For objective 2, if the damage from the event does not result in an automatic or forced plant shutdown/trip, the procedure determines if an OBE was exceeded. If so, then plant shutdown for further inspection and tests is accomplished. If the OBE was not exceeded, and no significant damage was found during the walkdown inspections, then shutdown of the plant is not considered necessary.

Finally, if the plant <u>is</u> shutdown (either initially or as a result of the event), guidance is provided to determine restart readiness per objective 3.

## 3.0 SCOPE/ENTRY CONDITIONS

3.1 Entry Conditions:

Any of the following:

– Yellow EVENT indicator Lit on front panel of Strong Motion Accelerometer System (CR)

– PRF-1-2, “Threshold Seismic Condition” actuated

– Red OBE indicator Lit on front panel of Strong Motion Accelerometer System (CR)

– PRF-1-3, “Operating Basis Earthquake” actuated

– Ground motion felt by station personnel

This procedure is designed for entry during all modes of plant operation. The primary indications of a seismic event are the seismic monitoring system and it’s annunciators (PRF-1-2 and PRF-1-3). However, since the seismic monitoring system is not safety related, it may not be available to diagnose the event. Therefore, entry into this AOP is also made whenever station personnel feel ground motion.

If an event is not strong enough to be sensed by the installed instrumentation or felt by station personnel, then entry into this procedure is not required. This would include events reported by or from off-site sources, including the National Earthquake Center. However, since this procedure is structured to diagnose and categorize the event before taking any action, entry under any circumstances is acceptable, (such as when station personnel are unsure whether or not they felt an earthquake).

## 4.0 IMMEDIATE ACTIONS

None – Memorized operator response before accessing the procedure is not required to successfully mitigate this event.

## 5.0 FOLLOW UP ACTIONS

The primary function of this procedure is to evaluate seismic events in order to screen out false alarms and minor earthquakes with a magnitude less than the Threshold Seismic Condition. Seismic events that are not screened out are then classified to determine the appropriate response. (Screening is accomplished by using dual confirmation between internal, external, and National Earthquake center data. Classification is accomplished using site-specific data, [if available], or by making conservative estimates from off-site data.)

Once an earthquake is classified, the procedure implements the appropriate actions to inspect for and correct any damage, perform a shutdown/cooldown if necessary, and evaluate the plant for continued operation and/or restart.

Specific steps are discussed below.

| Step Number | Discussion |
|---|---|
| Step 3.1 | Entry into any EOP or AOP is announced to ensure all operators are aware of major changes in plant conditions. This action also makes chemistry, maintenance and radiation protection personnel aware. |
| Step 3.2 | This continuous action step accomplishes the primary objective of this procedure which is to implement a plant shutdown and cooldown, if procedurally determined to be required. If plant damage from the earthquake allows, a controlled shutdown and cooldown is preferred, but provision is made to initiate and/or respond to a plant trip if required. (This step was placed as an IAAT early in the main text – instead of Attachment 3 – due to its importance.) |
| Step 3.3 | This step initiates evaluation of the Emergency Action Levels (EALs).<br>NOTE: The EAL criteria is slightly different from that in this AOP, in that the EAL classifications are solely based on functioning seismic instrumentation (with confirmation). The AOP goes beyond this limitation, and classifies the event regardless the seismic instrumentation status. Classification by the AOP will result in appropriate implementation of the EALs for either circumstance. |
| Step 3.4 | This step directs operator action if a seismic event occurs while the BWST is on cleanup IAW OP-TM-212-501 or Recirc IAW OP-TM-212-252 Step 4.2. This step is performed as a priority to isolate BWST cleanup in the event of a seismic event IAW TMI LAR TMI-15-071 |
| Step 3.5 | This continuous action step directs the user to step 3.7 (for performance of Attachment 3), if it is determined that a TSC or greater even has occurred. |

| Step Number | Discussion |
|---|---|
| Step 3.6 | This step directs the user to Attachment 1 if the plant seismic instrumentation or alarms are inoperable or did not respond to the event. (Thus, the only indication of the event would be that it was felt by station personnel.) Attachment 1 confirms and classifies the earthquake using sources external to the plant. |
| Step 3.7 | This step directs the user to Attachment 2 if the plant seismic instrumentation did respond to the event. Attachment 2 confirms the earthquake using one additional source (either a nearby facility, the National Earthquake Center, or confirmation by station personnel). It then classifies the earthquake using information provided on the seismic instrumentation printout. |
| NOTE in step 3.7 | This note is provided to alert the operator that a change in alarm status during procedure performance is a possibility, and does not necessarily indicate a new event that requires re-entry in the AOP. |
| Step 3.8 | This step directs the user to Attachment 3 whenever it is determined that a TSC or greater earthquake has occurred. This Attachment is where the majority of the event response is performed. |
| Step 3.9 | This is the end of the Follow Up actions of the main text and directs the user to Section 4.0. |
| Attachment 1 | This attachment is entered for earthquakes that are felt by station personnel but where seismic instrumentation/alarms are not available or did not respond. It uses the National Earthquake Center both to confirm the earthquake and provide its epicenter location and magnitude (Richter scale). Once confirmed, it conservatively classifies the earthquake as either an OBE or TSC, (using the distance between the epicenter and TMI), via either of two methods:<br><br>Method 1: If a nearby facility is determined to be closer to the epicenter, that facility is contacted and their seismic data is used to classify the earthquake.<br><br>Method 2: If data from a nearby facility cannot be used, the earthquake's magnitude and distance from the plant are used. If the earthquake was over a 6.0 magnitude at any distance from the plant, or over 5.0 magnitude within 125 miles of TMI, then it is classified as an OBE. Otherwise, it is classified as a TSC. (per Appendix A of RG 1.66)<br><br>Note that, since the earthquake was not alarmed, but rather felt and then confirmed, this attachment results in a declaration of either an OBE or TSC. This is necessary for adequate EAL classification, since their threshold values are based on an alarm and confirmation – which cannot occur if the instrumentation is OOS. |

| Step Number | Discussion |
|---|---|
| Attachment 2 | This attachment is entered for earthquakes that actuate the installed seismic instrumentation/alarms. It evaluates the earthquake using the information provided on seismic instrumentation printouts (with two figures provided as examples). It then confirms the earthquake using one additional source (either a nearby facility, the National Earthquake Center, or confirmation by station personnel). The classification can result in a TSC or OBE declaration, or, (in contrast to Attachment 1), no declaration at all. |
| Attachment 3 | This attachment is entered whenever it is determined that a TSC or larger magnitude earthquake has occurred. This attachment contains the actions necessary to respond to a confirmed earthquake. The individual steps of this attachment are described below: |
| Attachment 3, Step 4.1 | To prevent unnecessary performance of the included steps, the first step directs the user to verify that performance of this procedure has resulted in the declaration of either an Operating Basis Earthquake (OBE) or a Threshold Seismic Condition (TSC). |
| Attachment 3, Step 4.2 NOTE | This note informs the user that the remainder of the steps may be performed in any order or concurrently. |
| Attachment 3, Step 4.2 | This step determines if the earthquake or damage was severe enough to have potentially caused personnel injury. It then takes action by dispatching personnel to search for victims or performing personnel assembly/accountability. |
| Attachment 3, Step 4.3 | This step directs the user to initiate OP-TM-108-111-1001, TMI Severe Weather and Site Inaccessibility Guidelines. In case the earthquake affects access to the site, this procedure will provide adequate staffing for plant operations and E-Plan implementation while allowing unnecessary personnel to leave the site. |
| Attachment 3, Step 4.4 | This step, (performed regardless of event classification or plant operating condition), directs the user to initiate OP-AA-108-111-1001, “Severe Weather and Natural Disaster Guidelines (per Action 2 of AR 00777761). The section for seismic event provides guidelines for walkdowns and plant inspections, using CC-AA-5001, Post Transient or Scram Walkdown, and ER-AA-330-004, Visual Examination of Snubbers, as applicable.<br><br>The purpose of CC-AA-5001 is to identify any failures or degradation that could affect system operation and integrity. This will ensure deficiencies are identified and corrected.<br><br>The purpose of ER-AA-330-004 is to inspect snubbers (in this case, following a potentially damaging transient event) to ensure deficiencies are identified and corrected. |

| Step Number | Discussion |
|---|---|
| Attachment 3, Step 4.5 and its NOTE | If the plant is in operation, this step, (in conjunction with the walkdowns from Step 4.4), implements the recommendations of EPRI NP-6695, "Guidelines for Nuclear Power Plant Earthquake Response, by walking down all accessible areas to determine if earthquake damage requires a plant shutdown, or if continued operation is allowed. |
| Attachment 3, Step 4.6 | This step directs the user to notify the PDMS Manager to inspect TMI-2 for damage and to initiate 2301-1.1, "TMI-2 Reactor Vessel Fuel Removal/Rearrangement". (A valid seismic condition which triggers the U1 Earthquake Detection System is an entry condition to 2301-1.1) This ensures compliance with Unit 2 Technical Specification 3.2.1.2. **(CM-1)** |
| Attachment 3, Step 4.7 | The step ensures the BWST is not on cleanup IAW OP-TM-212-501or Recirc IAW OP-TM-212-252 Step 4.2. Since the Spent Fuel portion of the BWST piping that is used for these evolutions is not seismic, this minimizes the potential for loss of ECCS inventory. |
| Attachment 3, Step 4.8 | The step ensures that **no** releases are in progress. Since portions of the release systems are non-seismic, this minimized the potential for undesired/unmonitored releases. (per Action 2 of AR 00730406 from operations review of SEN 269) |
| Attachment 3, Step 4.9 | This step provides the action to be taken if the Spent Fuel Pool or the Spent Fuel Pool cooling system has been damaged. This step will also direct initiation of AOP-35 if the ability to monitor the Spent Fuel Pool has been lost. |
| Attachment 3, Step 4.10 | This step ensures adequate isolation for any steam leakage into the Auxiliary Building. |
| Attachment 3, Step 4.11 | This step provides the action to be taken if ISPH ventilation is lost. |
| Attachment 3, Step 4.12 | This step provides the action to be taken if DG Building ventilation is lost. |
| Attachment 3, Step 4.13 | This step provides the action to be taken if Control Building ventilation is lost. |
| Attachment 3, Step 4.14 | If EFW Pump Room ventilation is degraded, this step evaluates the recommendations of SA-AA-111, "Heat Stress Control". |

| Step Number | Discussion |
|---|---|
| Attachment 3, Step 4.15 | This step only applies if OBE limits were exceeded (thus requiring a plant shutdown).<br>Substep 1 initiates an inspection to verify the rack-to-rack and rack-to-wall gaps are maintained in Spent Fuel Pool A.<br>Substep 2 initiates the following when the plant is shutdown:<br>• The post-shutdown plant inspections and tests IAW EPRI NP-6695, "Guidelines for Nuclear Power Plant Earthquake Response<br>• OTSG inspection per EP-AP-420-003, TMI Unit 1: Steam Generator Eddy Current Activities<br>Substep 3 determines if the SSE criteria was exceeded using Attachment 4, Criteria for SSE Exceedance |
| Attachment 4 | This is a logic drawing that can be used to determine if the SSE criteria has been exceeded. It requires operability of the seismic instrumentation, (specifically the printout following an event), so may not be available in all cases. However, knowledge of SSE exceedence is only required for restart readiness evaluation, and is not, in any way, required for implementation of the response actions of this procedure. |

## 6.0 RETURN TO NORMAL

| | |
|---|---|
| RTN Step 4.1 NOTE | This note informs the user that the remainder of the steps may be performed in any order or concurrently. |
| RTN Step 4.1 | If the earthquake was determined to be less than a Threshold Seismic Condition, then the PDMS Manager is notified that no action is required |
| RTN Step 4.2 | If the Technical Support Center was activated, then recovery directions are obtained from the TSC. This will be the case for all earthquakes determined to have a magnitude at or above a Threshold Seismic Condition. |
| RTN Step 4.3 | This step has I&C perform Appendix 1 and 2 of 1105-17 to backup the Strong Motion Accelerometer and to Retrieve and Process the PRA Erasure Tapes. The backup will provide a historical file. The PRA tapes will provide an independent measure of the peak accelerations for each of the three planes on the three installed peak reading accelerographs. (These devices provide actual peak readings regardless of the availability or actuation status of the seismic instrumentation.) This also installs new PRA tapes to allow collection of subsequent readings on any aftershocks. While not directly applicable to the immediate classification of the event, this information will be useful in the post-event analysis relating to restart readiness (particularly if the seismic instrumentation was inoperable |

| | |
|---|---|
| | during the event). |
| RTN Step 4.4 | If the seismic event exceeded the OBE criteria, then the user is directed to obtain concurrence from the Plant Manager and the NRC prior to restart. |
| RTN Step 4.5 | This step provides direction for resetting all alarms associated with a seismic event. |

## 7.0 REFERENCES

7.1 Developmental References

7.1.1 1230-30, Earthquake, (R44)

7.1.2 EPRI NP-6695, Guidelines for Nuclear Plant response to an Earthquake

7.1.3 EPRI NP-5930, A Criterion for Determining Exceedance of the Operating Basis Earthquake

7.1.4 Unit 2 Technical Specification 3.2.1.2

7.1.5 RG 1.165, Identification And Characterization Of Seismic Sources And Determination Of Safe Shutdown Earthquake Ground Motion

7.1.6 RG 1.166, Pre-Earthquake Planning And Immediate Nuclear Power Plant Operator Post-earthquake Actions

7.1.7 RG 1.167, Restart Of A Nuclear Power Plant Shut Down By A Seismic Event

7.2 Implementing References

7.2.1 1102-4, Power Operation

7.2.2 1102-10, Plant Shutdown

7.2.3 1102-11, Plant Cooldown

7.2.4 1105-17, Earthquake Monitoring System

7.2.5 EOP-001, Reactor Trip Or Safety Injection

7.2.6 OP-TM-AOP-034, Loss of Control Building Cooling

7.2.7 OP-AA-108-111-1001, Severe Weather and Natural Disaster Guidelines

7.2.8 OP-TM-108-111-1001, TMI Severe Weather and Site Inaccessibility Guidelines

7.2.9 OP-TM-212-501, Cleanup of the BWST

7.2.10 OP-TM-535-901, Emergency Ventilation of Screen House

7.2.11 OP-TM-861-910, Emergency Ventilation of EG-Y-1A Room

7.2.12 OP-TM-861-911, Emergency Ventilation of EG-Y-1B Room

7.2.13 SA-AA-111, Heat Stress Control

7.2.14 EP-AP-420-003, TMI Unit 1: Steam Generator Eddy Current Activities

7.2.15 2301-1.1, TMI-2 Reactor Vessel Fuel Removal/Rearrangement

7.3 Commitment

7.3.1 **CM-1** Action Tracking Item AR00603573.28 License Renewal Structures Monitoring Program (Step 4.6 “Attachment 3”, OP-TM-AOP-003 Step 4.6).

## 8.0 VALIDATION

8.1 Scenario #1:

8.1.1 100% RTP, no OOS equipment. PRF 1-2, Threshold Seismic Condition actuates. Various high vibration alarms actuate, but clear when silenced. Various tank levels show oscillations. No other abnormalities are readily apparent. Report received from the field personnel that an earthquake occurred.

8.1.2 Three minutes after the event starts, PRF 1-3, Operating Basis Earthquake actuates and the crew is provided the seismic printout for Scenario #1. This printout should show that an OBE was exceeded. Fifteen minutes after the original earthquake, a slightly smaller aftershock occurs and re-alarms PRF 1-2.

8.2 Scenario #2:

8.2.1 100% RTP, the Strong Motion Accelerometer System is deenergized for maintenance. One or more control room staff “feel” an earthquake. Various tank levels show minor oscillations. No other abnormalities are readily apparent. Report received from the field personnel that we may have had an earthquake.

8.2.2 The National Earthquake Center reports that the magnitude was 5.7 and the location was 41°25’45”N by 74°30’40”W (5 miles W-SW of Middletown, NY) Susquehanna plant is determined to be the closest facility and reports that they did experience an earthquake, but it had a magnitude less than an OBE.

## 9.0 SETPOINTS

| **Procedural / Equipment Setpoints** | | |
|---|---|---|
| **Parameter** | **Value** | **Confirmation** |
| PRF-1-2, Threshold Seismic Condition (TSC) | 0.01g | Confirmation via one of the following:<br>• ”Felt” by station personnel<br>• IV’d from an external source |
| PRF-1-3, Operating Basis Earthquake (OBE) | Calculated value, based on seismic spectra curve for TMI | Confirmation via one of the following:<br>• ”Felt” by station personnel<br>• IV’d from an external source |
| TSC with TMI seismic instrumentation inoperable & **other** site closer to epicenter | Anything below the OBE setpoints in use at the closer site | Confirmation:<br>• “Felt” by station personnel |
| OBE with TMI seismic instrumentation inoperable & **other** site closer to epicenter | OBE setpoints in use at the closer site | Confirmation:<br>• “Felt” by station personnel |
| TSC with TMI seismic instrumentation inoperable & **no** site closer to epicenter | Magnitude reported by the National Earthquake Center (NEC) < the OBE limits listed in the row below | Confirmation:<br>• “Felt” by station personnel |
| OBE with TMI seismic instrumentation inoperable & **no** site closer to epicenter | Magnitude reported by NEC either:<br>≥ 6.0 (Richter Scale) at any distance from plant<br>≥ 5.0 (Richter Scale) within 125 miles of TMI | Confirmation:<br>• “Felt” by station personnel |
| SSE based on TMI seismic instrumentation | Any frequency > twice the OBE limit (as shown on the seismic instrumentation printout) | Confirmation:<br>• Any other frequency > 2/3 the OBE limit |

| **TMI Design Data** | | |
|---|---|---|
| **Parameter** | **Value** | **Comment** |
| OBE | 0.06g horizontal and 0.04g vertical | |
| Safe Shutdown Earthquake (SSE) | 0.12g horizontal and 0.08g vertical | |

## 10.0 EXIT CRITERIA

This AOP concludes at one of three end points, based on the severity of the earthquake:

1. Earthquake causing minimal damage and determined to be less than TSC; Unless the event caused an automatic shutdown, no plant manipulation is taken and no emergency action level is entered.

2. Earthquake causing minimal damage and determined to be $\geq$ TSC, but < OBE; Unless the event caused an automatic shutdown, plant operation remains in it's pre-earthquake condition. Unusual Event is declared and applicable actions are taken per Attachment 3.

3. Earthquake causing damage sufficient to warrant a shutdown or determined to be $\geq$ OBE; Plant is shutdown (or tripped). Alert is declared and all actions are taken per Attachment 3. Plant restart requires NRC concurrence.

**ATTACHMENT 8**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

**PROPOSED TECHNICAL SPECIFICATION BASES MARKED-UP PAGE**
**(FOR INFORMATION ONLY)**

**Page 3-23**

3.3 EMERGENCY CORE COOLING, REACTOR BUILDING EMERGENCY COOLING AND REACTOR BUILDING SPRAY SYSTEMS (Contd.)

3.3.2 Maintenance or testing shall be allowed during reactor operation on any component(s) in the makeup and purification, decay heat, RB emergency cooling water, RB spray, BWST level instrumentation, or cooling water systems which will not remove more than one train of each system from service. Components shall not be removed from service so that the affected system train is inoperable for more than 72 consecutive hours. If the system is not restored to meet the requirements of Specification 3.3.1 within 72 hours, the reactor shall be placed in a HOT SHUTDOWN condition within six hours.

3.3.2.1 If the CFT boron concentration is outside of limits, or if the TSP baskets contain amounts of TSP outside the limits specified in 3.3.1.3.b, restore the system to operable status within 72 hours. If the system is not restored to meet the requirements of Specification 3.3.1 within 72 hours, the reactor shall be placed in a HOT SHUTDOWN condition within six hours.

3.3.3 Exceptions to 3.3.2 shall be as follows:

a. Both CFTs shall be OPERABLE at all times.

b. Both the motor operated valves associated with the CFTs shall be fully open at all times.

c. One reactor building cooling fan and associated cooling unit shall be permitted to be out-of-service for seven days.

3.3.4 Prior to initiating maintenance on any of the components, the duplicate (redundant) component shall be verified to be OPERABLE.

Bases

The requirements of Specification 3.3.1 assure that, before the reactor can be made critical, adequate engineered safety features are operable. Two engineered safeguards makeup pumps, two decay heat removal pumps and two decay heat removal coolers (along with their respective cooling water systems components) are specified. However, only one of each is necessary to supply emergency coolant to the reactor in the event of a loss-of-coolant accident. Both CFTs are required because a single CFT has insufficient inventory to reflood the core for hot and cold line breaks (Reference 1).

The operability of the borated water storage tank (BWST) as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA (Reference 2). The limits on BWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain at least one percent subcritical following a Loss-of-Coolant Accident (LOCA).

The contained water volume limit of 350,000 gallons includes an allowance for water not usable because of tank discharge location and sump recirculation switchover setpoint. Redundant heaters maintain the borated water supply at a temperature greater than 40°F.

The Reactor Building emergency sump pH control system ensures a sump pH between 7.3 and 8.0 during the recirculation phase of a postulated LOCA. A minimum pH level of 7.3 is required to reduce the potential for chloride induced stress corrosion cracking of austenitic stainless steel and assure the retention of elemental iodine in the recirculating fluid. A maximum pH value of 8.0 minimizes the



The BWST can be placed on cleanup path, or recirculation path for weekly surveillance testing for boron concentration, on a temporary basis, until the end of the Fuel Cycle 21 operation. A seismic evaluation has been performed that concluded the cleanup and recirculation seismic Class II piping paths would maintain pressure boundary integrity during a Safe Shutdown Earthquake (SSE). The seismic Class I BWST would maintain its safety functions during an SSE. The limiting condition for operation (LCO) for BWST cleanup operation is a total duration of not more than 720 hours (30 days) prior to Fall 2015 Refueling Outage and is a total duration of not more than 1440 hours (60 days) during Fuel Cycle 21 operation. BWST Cleanup can be started and stopped at any time as long as the total durations are not exceeded. The LCO for BWST recirculation operation is limited to time it takes to adequately recirculate the BWST volume to perform the boron sampling surveillance, which is approximately 30 hours per week. The temporary LCOs are in effect to allow time for a permanent solution to the issue of interconnecting seismic Class I and II piping during BWST cleanup and recirculation operation.

**ATTACHMENT 9**

**THREE MILE ISLAND NUCLEAR STATION, UNIT 1**

**PROCEDURE OP-TM-212-252,**
**"RECIRCULATION AND SAMPLING OF BWST (DH-T-1)"**

# RECIRCULATION AND SAMPLING OF BWST (DH-T-1)

## 1.0 PURPOSE

1.1 Recirculate and sample Borated Water Storage Tank (DH-T-1) for weekly sample or following makeup / chemical additions to ensure compliance with the following:

- BWST boron ≥ 2550 ppm Boron (Technical Specification 3.3.1.1.a minimum plus 2% analysis uncertainty) and < 2750 ppm Boron.
- BWST temperature > 40°F.
- T/S Table 4.1-3, Item 2

## 2.0 MATERIAL AND SPECIAL EQUIPMENT

None

## 3.0 PRECAUTIONS, LIMITATIONS, AND PREREQUISITES

3.1 Precautions

None

3.2 Limitations

None

3.3 Prerequisites

3.3.1 **VERIFY** BWST level greater than 9.5'. ____

3.3.2 **If** using SF System for recirc IAW Step 4.2, **then VERIFY** Spent Fuel lined up IAW 1104-6, Spent Fuel Cooling System. ____

3.3.3 **If** using DH System for recirc IAW Step 4.3 or 4.4, **then VERIFY** DH Trains A and B in ES Standby Mode IAW OP-TM-212-000, Decay Heat Removal System. ____

3.3.4 **If** using BS for recirc IAW Step 4.5 or 4.6, **then VERIFY** BS Trains A and B in ES Standby Mode IAW OP-TM-214-000, Building Spray System. ____

## 4.0 MAIN BODY

4.1 **VERIFY** all prerequisites have been met. ____

NOTE: Only one section (4.2, 4.3, 4.4, 4.5, or 4.6) is performed to recirculate and sample the BWST.

4.2 **If** sampling BWST using recirculation via SF-P-2, **then** perform the following: ____

4.2.1 **PLACE** BWST on recirc IAW OP-TM-212-501, Cleanup of the BWST. ____

4.2.2 **RECORD** date and time BWST placed on recirc.

Date_____ Time_____

4.2.3 **When** BWST recirculation time meets one of the following:

- BWST level has been within 1 foot (±) of current reading during last 7 days (PPC A0486 or A0487) and minimum recirc time > 24 hours,
- BWST level has exceeded a 1 foot change from current reading during last 7 days (PPC A0486 or A0487) and minimum recirc time > 6 days,

**then NOTIFY** Chemistry to sample BWST (DH-T-1) IAW CY-TM-551-807, Chemistry Primary Sampling. ____

4.2.4 **GO TO** Step 4.7. ____

4.3 **If** sampling BWST using recirculation via DH Train A, **then** perform the following: ____

4.3.1 **VERIFY** DH Train B in ES Standby Mode and all support systems are available. ____

4.3.2 **ENSURE** DC-P-1A operating (CC). ____

4.3.3 **ENSURE OPEN** DH-V-5A (CC). ____

4.3.4 **REQUEST** Shift Management to declare DH-P-1A Inoperable **and INITIATE** a 72 hour time clock per T.S. 3.3.2. ____

4.3.5 **UNLOCK and OPEN** DH-V-21. ____

NOTE: Substep 4.3.6.3 is to be quickly performed after pump start.

4.3.6 Start DH-P-1A as follows:

1. **UNLOCK** DH-V-20A. ____
2. **START** DH-P-1A (CC). ____
3. **THROTTLE OPEN** DH-V-20A to obtain ~ 800 gpm on DH-FI-802A (CC). ____

4.3.7 **When** > 30 minutes recirculation has elapsed, **then NOTIFY** Chemistry to sample Decay Heat Removal Cooler Outlet sample point IAW CY-TM-551-807, Primary Chemistry Sampling. ____

4.3.8 **When** sample has been obtained, **then** secure recirc as follows: ____

1. **SECURE** DH-P-1A (CC) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

2. **LOCK CLOSED** DH-V-20A. ____

____ ____
IV Date

3. **LOCK CLOSED** DH-V-21. ____

____ ____
IV Date

4. **REQUEST** Shift Management to declare DH-P-1A Operable. ____

4.3.9 **If** DC Train A is **not** required for component cooling, **then STOP** DC-P-1A **and PLACE** in Normal After Stop (CC). ____

____ ____
IV Date

4.3.10 **GO TO** Step 4.7. ____

4.4 **If** sampling BWST using recirculation via DH Train B, **then** perform the following: ____

4.4.1 **VERIFY** DH Train A in ES Standby Mode **and** all support systems are available. ____

4.4.2 **ENSURE** DC-P-1B operating (CR). ____

4.4.3 **ENSURE OPEN** DH-V-5B (CR). ____

4.4.4 **REQUEST** Shift Management to declare DH-P-1B Inoperable **and INITIATE** a 72 hour time clock per T.S. 3.3.2. ____

4.4.5 **UNLOCK and OPEN** DH-V-21. ____

NOTE: Substep 4.4.6.3 is to be quickly performed after pump start.

4.4.6 Start DH-P-1B as follows:

1. **UNLOCK** DH-V-20B. ____
2. **START** DH-P-1B (CR). ____
3. **THROTTLE OPEN** DH-V-20B to obtain ~ 800 gpm on DH-FI-803A (CR). ____

4.4.7 **When** > 30 minutes recirculation has elapsed, **then NOTIFY** Chemistry to sample Decay Heat Removal Cooler Outlet sample point IAW CY-TM-551-807, Primary Chemistry Sampling. ____

4.4.8 **When** sample has been obtained, **then** secure recirc as follows: ____

1. **SECURE** DH-P-1B (CR) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

2. **LOCK CLOSED** DH-V-20B. ____

____ ____
IV Date

3. **LOCK CLOSED** DH-V-21. ____

____ ____
IV Date

4. **REQUEST** Shift Management to declare DH-P-1B Operable. ____

4.4.9 **If** DC Train B is **not** required for component cooling, **then STOP** DC-P-1B (CR) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

4.4.10 **GO TO** Step 4.7. ____

4.5 **If** sampling BWST using recirculation via BS Train A, **then** perform the following:

4.5.1 **VERIFY** BS Train B in ES Standby Mode and all support systems are available. ____

4.5.2 **ENSURE** DC-P-1A operating (CC). ____

4.5.3 **ENSURE OPEN** DH-V-5A (CC). ____

4.5.4 **REQUEST** Shift Management to declare BS-P-1A inoperable **and INITIATE** a 72 hour time clock per T.S. 3.3.2. ____

4.5.5 **OPEN** BS-V-3A (CC). ____

4.5.6 **VERIFY** BS-V-1A is Closed. ____

4.5.7 **PLACE** 1A ES Valves MCC, Unit 5C (BS-V-1A) in Off. ____

NOTE: An Operator must remain in the area near BS-V-47A any time the valve is open. The Operator is responsible to close BS-V-47A prior to leaving the area or if 4 psig ESAS actuates.

4.5.8 **REMOVE** cap at BS-V-47A **and ATTACH** tubing to drain funnel. ____

4.5.9 **IAAT** BS-V-47A is Open **and** 4 psig ESAS actuates, **then CLOSE** BS-V-47A. ☐

NOTE: BS-V-47A is maintained open to prevent any leakage past BS-V-1A from filling the BS header.

4.5.10 **OPEN** BS-V-47A. ____

4.5.11 **UNLOCK and OPEN** BS-V-60A. ____

4.5.12 **UNLOCK and THROTTLE OPEN** BS-V-59 2 ½ turns. ____

4.5.13 **VERIFY** adequate BS-P-1A lube oil level in bearing sight glasses. ____

4.5.14 **PLACE** BS-P-1A in Normal-After-Start. ____

4.5.15 **If** flow through BS-V-47A is greater than 1/8 inch pencil stream, **then**

1. **NOTIFY** Shift Management to evaluate continued use of BS-P-1A for BWST recirculation. ____

2. **INITIATE** IR which describes BS-V-1A leakage. ____

NOTE: L2672, BS-P-1A Flow – Lo, will be in alarm with BS-P-1A flow less than 900 gpm.

**CAUTION**

Maximum allowable flow is 1700 gpm with suction from the BWST. Minimum allowable flow is 60 gpm. Maximum allowable time for operation at a flow < 60 gpm is 60 seconds.

4.5.16 **THROTTLE** BS-V-59 to obtain ~ 800 gpm on BS1-FI-1. ____

4.5.17 **When** > 30 minutes recirculation has elapsed, **then NOTIFY** Chemistry to sample BWST (DH-T-1) IAW CY-TM-551-807, Chemistry Primary Sampling. ____

4.5.18 **When** sample has been obtained, **then** secure recirc as follows: ____

1. **SECURE** BS-P-1A (CC) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

2. **CLOSE** BS-V-47A. ____

____ ____
IV Date

3. **REMOVE** the drain tubing from BS-V-47A **and REPLACE** the cap. ____

____ ____
IV Date

4. **LOCK CLOSED** BS-V-60A. ____

____ ____
IV Date

5. **LOCK CLOSED** BS-V-59. ____

____ ____
IV Date

6. **CLOSE** BS-V-3A. ____

____ ____
IV Date

7. **CLOSE** breaker for BS-V-1A (1A ES valves MCC, Unit 5C). ____

____ ____
IV Date

8. **REQUEST** Shift Management to declare BS-P-1A Operable. ____

4.5.19 **If** DC Train A is **not** required for component cooling, **then STOP** DC-P-1A (CC) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

4.5.20 **GO TO** Step 4.7. ____

4.6 **If** sampling BWST using recirculation via BS Train B, **then** perform the following:

4.6.1 **VERIFY** BS Train A in ES Standby Mode and all support systems are available. ____

4.6.2 **ENSURE** DC-P-1B operating (CR). ____

4.6.3 **ENSURE OPEN** DH-V-5B (CR). ____

4.6.4 **REQUEST** Shift Management to declare BS-P-1B Inoperable **and INITIATE** a 72 hour time clock per T.S. 3.3.2. ____

4.6.5 **OPEN** BS-V-3B. ____

4.6.6 **VERIFY** BS-V-1B is Closed. ____

4.6.7 **PLACE** 1B ES Valves MCC, Unit 7B (BS-V-1B) in Off. ____

NOTE: An Operator must remain in the area near BS-V-47B any time the valve is open. The Operator is responsible to close BS-V-47B prior to leaving the area or if 4 psig ESAS actuates.

4.6.8 **REMOVE** cap at BS-V-47B **and ATTACH** tubing to drain funnel. ____

4.6.9 **IAAT** BS-V-47B is Open **and** 4 psig ESAS actuates, **then CLOSE** BS-V-47B. ☐

NOTE: BS-V-47B is maintained open to prevent any leakage past BS-V-1B from filling the BS header.

4.6.10 **OPEN** BS-V-47B. ____

4.6.11 **UNLOCK and OPEN** BS-V-60B. ____

4.6.12 **UNLOCK and THROTTLE OPEN** BS-V-59 2 ½ turns. ____

4.6.13 **VERIFY** adequate BS-P-1B lube oil level in bearing sight glasses. ____

4.6.14 **PLACE** BS-P-1B in Normal-After-Start. ____

4.6.15 **If** flow through BS-V-47B is greater than 1/8 inch pencil stream, **then**

1. **NOTIFY** Shift Management to evaluate continued use of BS-P-1B for BWST recirculation. ____

2. **INITIATE** IR which describes BS-V-1B leakage. ____

NOTE: L2674, BS-P-1B Flow – Lo, will be in alarm with BS-P-1B flow less than 900 gpm.

**CAUTION**

Maximum allowable flow is 1700 gpm with suction from the BWST. Minimum allowable flow is 60 gpm. Maximum allowable time for operation at a flow < 60 gpm is 60 seconds.

4.6.16 **THROTTLE** BS-V-59 to obtain ~ 800 gpm on BS1-FI-2. ____

4.6.17 **When** > 30 minutes recirculation has elapsed, **then NOTIFY** Chemistry to sample BWST (DH-T-1) IAW CY-TM-551-807, Chemistry Primary Sampling. ____

4.6.18 **When** sample has been obtained, **then** secure recirc as follows: ____

1. **SECURE** BS-P-1B (CR) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

2. **CLOSE** BS-V-47B. ____

____ ____
IV Date

3. **REMOVE** the drain tubing from BS-V-47B **and REPLACE** the cap. ____

____ ____
IV Date

4. **LOCK CLOSED** BS-V-60B. ____

____ ____
IV Date

5. **LOCK CLOSED** BS-V-59. ____

____ ____
IV Date

6. **CLOSE** BS-V-3B. ____

____ ____
IV Date

7. **CLOSE** breaker for BS-V-1B (1B ES valves MCC, Unit 7B). ____

____ ____
IV Date

8. **REQUEST** Shift Management to declare BS-P-1B operable. ____

4.6.19 **If** DC Train B is **not** required for component cooling, **then STOP** DC-P-1B (CR) **and PLACE** in Normal After Stop. ____

____ ____
IV Date

4.6.20 **GO TO** Step 4.7 ____

4.7 **When** BWST boron results are obtained, **then** perform the following: ____

4.7.1 **RECORD** Boron results on Attachment 7.1, BWST (DH-T-1) Analysis Results. ____

4.7.2 **CONTACT** Control Room for information **and RECORD** BWST temperature on Attachment 7.1, BWST (DH-T-1) Analysis Results, using one of the following based on current BWST level: ____

- > 3' but < 26' – PPC A0105
- > 26' but < 52' – PPC A0104
- > 52' – DH4-TE (CC)

4.7.3 **RECORD** sample results in CR Log. ____

4.7.4 Compare new boron value to previous boron concentration as follows:

1. **OBTAIN** most recent boron concentration for BWST. ____
2. **REPORT** new boron number and previous boron number to Shift Manager. ____
3. **If** BWST boron concentration is less than 2550 ppm, **and** Reactor is critical, **then RESTORE** BWST to operable within 8 hours (See T.S. 3.3.1.1a). ____
4. **If** BWST temperature is < 40°F, **and** Reactor is critical, **then RESTORE** BWST to operable within 8 hours (See T.S. 3.3.1.1a). ____
5. **If** BWST boron concentration is < 2600 ppm, **then FORWARD** a copy of the data sheet to Chemistry Supervision. ____
6. **If** BWST boron concentration is > 2750 ppm, **then NOTIFY** Shift Manager to restore boron concentration to <2750 ppm. ____

4.8 **When** BWST sample results are acceptable, **then NOTIFY** the Control Room that the BWST may be taken off recirc. IAW OP-TM-212-501, Cleanup of the BWST. ____

| DATE | PRINTED NAME | SIGNATURE | (INITIAL ONE) | |
|---|---|---|---|---|
| | | | INITIALS | IV/CV INITIALS |
| | | | | |
| | | | | |
| | | | | |

## 5.0 RETURN TO NORMAL

None

## 6.0 REFERENCES

6.1 Developmental References

6.1.1 OP-TM-212-000, Decay Heat Removal System

6.2 Implementing References

6.2.1 CY-TM-551-807, Primary Chemistry Sampling

6.2.2 OP-TM-212-501, Cleanup of the BWST

6.2.3 OP-TM-212-000, Decay Heat Removal System

6.2.4 1104-6, Spent Fuel Cooling System

6.3 Commitments

None

## 7.0 ATTACHMENTS

7.1 BWST (DH-T-1) Analysis Results

7.2 Device Locator List

**ATTACHMENT 7.1**
**BWST (DH-T-1) Analysis Results**
**Page 1 of 1**

Date/Time of Sample _____

**Analysis:**

Boron, ppm _____

Acceptance Criteria: Boron ≥ 2550 ppm and < 2750 ppm

BWST temperature _____

Acceptance Criteria: > 40°F

Performed By_____ Date/Time_____/_____

Approved By_____ Date/Time_____/_____

## ATTACHMENT 7.2
## Device Locator List
## Page 1 of 1

| DEVICE | DESCRIPTION | LOCATION | | |
|---|---|---|---|---|
| | | ELEV | BLDG | AREA |
| BS-V-47A | BS-P-1A Disch Test Valve | 281 | AB | Above small leakoff funnel along RB wall 8 ft above floor |
| BS-V-47B | BS-P-1B Disch Test Valve | 281 | AB | Above small leakoff funnel along RB wall 8 ft above floor |
| BS-V-59 | BS Pump to BWST Isolation Valve | 281 | AB | Chain valve near RB wall 6 ft NW of large leakoff funnel 8 ft above floor |
| BS-V-60A | BS-P-1A Recirc to BWST Isolation | 281 | AB | Near small leakoff funnel along RB wall 5 ft West of funnel 6 ft above floor |
| BS-V-60B | BS-P-1B Recirc to BWST Isolation | 281 | AB | Near small leakoff funnel along RB wall |
| DH-V-153 | BWST Recirc Line Sample Isol | 281 | AB | 6' North of BS-P-1A Vault Hatch |
| DH-V-180 | BWST Sample Valve | 281 | AB | 4' East of Spray Vault A entrance |
| DH-V-20A | DH-P-1A Cleanup/ Recirc to BWST | 281 | AB | Between Large & Sm Leakoff Funnel S, 6ft from RB wall, 7ft off floor |
| DH-V-20B | DH-P-1B Cleanup/ Recirc to BWST | 281 | AB | 7' N of entrance to B DH Vault, 8' above floor |
| DH-V-21 | DH-P-1s Recirc to the BWST | 281 | AB | 6ft E of ent to B Spray Vlt, 9ft above floor Chain Operated Valve |
| DH-V-31 | BWST Recirc Line Sample Isol | 281 | AB | 4' East of entrance to A Spray Vault, 4' above floor |
| DH-V-5A-EX1 | DHV5A Control Switch | 355 | CR | (CR) |
| DH-V-5B-EX1 | DHV5B Control Switch | 355 | CR | (CR) |