



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
REGION I  
2100 RENAISSANCE BLVD., SUITE 100  
KING OF PRUSSIA, PA 19406-2713

April 11, 2014

Mr. Michael J. Pacilio  
Senior Vice President, Exelon Generation Company, LLC  
President and Chief Nuclear Officer, Exelon Nuclear  
4300 Winfield Rd.  
Warrenville, IL 60555

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 - NRC LICENSE  
RENEWAL COMMITMENTS INSPECTION REPORT 05000289/2014008

Dear Mr. Pacilio:

On March 7, 2014, the U.S. Nuclear Regulatory Commission (NRC) completed a license renewal commitments inspection at your Three Mile Island, Unit 1 (TMI) facility. The enclosed inspection report documents the inspection results, which were discussed on March 7, 2014, with Mr. Joseph Dullinger, Director of Site Engineering, and other members of your staff during an exit meeting.

The inspection examined the actions taken to complete commitments Exelon made as part of your application for a renewed license. The inspectors reviewed selected aging management programs, observed activities and interviewed station personnel to determine if the selected commitments had been fulfilled.

Based on the results of this inspection, the NRC has concluded the commitments are, or will be, completed and there is reasonable assurance aging will be effectively managed during the extended period of operation.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure and your response (if any), will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records System (PARS) component of the NRC's document system, Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web Site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Mel Gray, Chief  
Engineering Branch 1  
Division of Reactor Safety

Docket No.: 50-289  
License No.: DPR-50

M. Pacilio

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION I**

Docket No.: 50-289

License No.: DPR-50

Report Nos.: 05000289/2014008

Licensee: Exelon Generating Company, LLC

Facility: Three Mile Island Station, Unit 1

Location: Middletown, PA 17057

Dates: November 12 - 15, 2013; February 18 – 21; March 4 - 7, 2014

Inspectors: M. Modes, Senior Reactor Inspector (Team Leader)  
Division of Reactor Safety (DRS)  
G. Meyer, Senior Reactor Inspector, DRS  
S. Chaudhary, Reactor Inspector, DRS  
D. Tifft, State Liaison Officer, DRS

Approved by: Mel Gray, Chief  
Engineering Branch 1  
Division of Reactor Safety

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## **SUMMARY OF FINDINGS**

IR 05000289/2014008, 11/12 - 15, 2013; 2/18 – 21 & 3/4 - 7, 2014; Exelon Generation Company, LLC; Three Mile Island, Unit 1; License Renewal Commitments Inspection.

This report covered a two week on-site team inspection utilizing IP71003, "License Renewal Commitments Inspection", by specialist inspectors. This inspection verifies that selected commitments, identified at the time a renewal license was granted, have been met.

No findings were identified.

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## REPORT DETAILS

### 4. OTHER ACTIVITIES (OA)

#### 4OA5 License Renewal Follow-up (IP 71003)

##### Background

The NRC conducted this inspection using the guidance of Inspection Procedure (IP) 71003 "Post-Approval Site Inspection for License Renewal." The primary objective of Inspection Procedure 71003 is to verify a renewed operating licensee completes license renewal commitments in a timely manner. The documentation for this inspection is different from the documentation of baseline inspections because this inspection includes qualitative conclusions and is separately covered by Inspection Manual Chapter, IMC 2516, "A Policy and Guidance for the License Renewal Inspection Programs."

##### Purpose of Inspection

The NRC observed license renewal activities during the last refueling outage prior to entering the period of extended operation, during the period November 12 - 15, 2013. Additionally an NRC inspection team reviewed selected commitments during the period February 18 – 21 and March 4 - 7, 2014. Inspection observations and reviews were made of license renewal commitments selected from NUREG-1928, "Safety Evaluation Report Related to the License Renewal of Three Mile Island Nuclear Station, Unit 1: Docket No. 50-289, Exelon Generation Company, LLC " (ML092950450), issued October 2009.

The inspection included observations of license renewal commitments which were existing programs and enhancements to existing programs already implemented under the current license. The inspection included a review of selected aging management programs supporting the implementation of commitments. For each commitment the inspectors reviewed supporting documents including completed surveillances, conducted interviews, performed visual inspection of structures and components and observed selected activities to verify the licensee conducted the necessary actions to complete the commitments. When the performance of an existing program was evaluated by the inspectors, the basis for the evaluation was the current licensing basis as well as the features of a renewed license. License renewal enhancements were considered separately in the evaluation. For license renewal activities the report documents inspector observations, because the license renewal commitments do not have to be completed until the facility enters the extended period of operation beginning midnight April 19, 2014.

##### Sample Selection Process

The reviewed commitments, license conditions and enhanced aging management programs were selected based on several attributes including: risk significance using the NRC Risk-Informed Inspection Notebook for Three Mile Island Unit 1, Revision 2.1a; the results of previous license renewal audits and inspections of aging management programs; the complexity

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in implementing a commitment; and the extent to which the baseline inspection programs will inspect attributes of the commitment, license condition or aging management program. Consideration is given to the amount of time since the renewed license was granted and beginning of the period of extended operation.

The inspectors selectively verified the licensee implemented the aging management programs, included in the staff's license renewal safety evaluation report, in accordance with Title 10 of the *Code of Federal Regulations* Part 54, "Requirements for the Renewal of Operating Licenses for Nuclear Power Plants." The inspectors verified a selected sample of licensee corrective actions that were the result of license renewal activities.

### Commitment Management

During this inspection the inspectors verified that changes, if any, to these commitments were identified and properly reviewed and approved. The inspectors noted the implementation of the license renewal aging management program, "Above Ground Tanks", included a subsidiary commitment to perform a visual inspection of the Sodium Hydroxide Tank, in lieu of an ultrasonic thickness evaluation of the tank bottom. In a letter dated September 12, 2013, Exelon informed the NRC the Sodium Hydroxide Tank is no longer used and the visual inspection would be performed as part of the External Surfaces Monitoring Program. The inspectors concluded Exelon was correctly applying the commitment management process stipulated in NEI 99-04 [Revision 0], "Guidelines for Managing NRC Commitment Changes," (ML0036800880) when informing the NRC about this change.

Specific documents reviewed by the team are listed in the attachment to this report.

#### .01 IWB, IWC, IWD, ISI Implementation

Commitment 1 – "The ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program is being implemented."

##### a. Inspection Scope

These programs are implemented as part of compliance with 10 CFR 50.55a and inspected regularly by the NRC using inspection IP7111.08P "ISI Inspection". This inspection is implemented during every refueling outage. As a consequence the NRC has ample evidence the licensee is implementing this commitment to completion. Notwithstanding, the inspectors reviewed the following programmatic documentation to verify the programs are being implemented in compliance with the current requirements.

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ER-AA-330, Revision 10, Conduct of Inservice Inspection Activities

TM104.G05, "ISI Selection Document, Fourth Ten-Year Inspection Interval", Revision 1, February 16, 2012, has the following seven associated commitments:

- AR603573.01, License Renewal ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD
- AR603573.07, License Renewal Bolting Integrity Program
- AR603573.26, License Renewal ASME Section XI Inservice Inspection, Subsection IWF Program
- AR603573.35, License Renewal Nickel Alloy Aging Management Program
- AR603573.05, Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of PWRs
- AR603573.05, License Renewal Nickel Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors Program
- AR603573.05, License Renewal ASME Section XI Inservice Inspection, Subsection IWE

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.02 Reactor Head Closure Studs

Commitment 3 – “The Reactor Head Closure Studs Program is being implemented. The program will be enhanced to select an alternate stable lubricant that is compatible with the fastener material and the environment.”

a. Inspection Scope

The NRC Safety Evaluation Report noted there was no specific reference to leak detection of the studs. The inspectors verified the reference was included in Program Basis Document TM-PBD-AMP-B.2.1.3, Revision 3. The inspectors reviewed Revision 8 of OP-TM-220-261, Reactor Coolant System VT-2 Exam, to verify stud leakage was being monitored. In the Safety Evaluation Report the NRC recognized Exelon used a disulfide molybdenum compound for lubricating the reactor closure studs. The NRC noted the use of a disulfide molybdenum compound was identified as a common factor in stress corrosion cracking failure in Electric Power Research Institute document, EPRI-5769, Volume 1, Section II. Exelon planned to change the lubricating compound, in conformance with the commitment, to a compound absent disulfides. The inspectors

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reviewed the material safety data sheet for the proposed lubricating compound and Exelon Equivalency Evaluation IEC/ECR 11-00435, Rev 0. Exelon recognized the substitute lubricant, DAG 156, has a service limit of 400° F and reactor exposure is 600° F. The manufacturer recommended three things to make the lubricant serviceable at 600° F.

- During disassembly remove all residual lubricant from the studs and stud holes.
- During application keep DAG 156 well mixed and apply in a thin coat.
- Maximize the dry time. It was noted the MSDS indicated the cure time was 5 minutes.

The inspectors determined none of these steps appeared in MA-TM-134-903 "Reactor Vessel Disassembly Revision 11, MA-TM-134-904, Reactor Vessel Reassembly, Revision 8, and MA-TM-134-906, Reactor Vessel Reassembly Preparation, Revision 4. Exelon investigated this omission through Nuclear Issue 01630008 which resulted in confirmation of the omission and a subsequent corrective action to revise the procedures.

b. Findings

The inspectors concluded, with the corrective action in place, the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.03 Steam Generator Integrity

Commitment 8 – "The Steam Generator Tube Integrity Program is being implemented."

a. Inspection Scope

The inspectors verified the steam generators were replaced during the refueling outage ending January 2010. This program receives a comprehensive review by the NRC during every outage using Inspection Procedure IP71111.08P "ISI Inspection". The inspectors reviewed the steam generator tube integrity program and discussed recent inspection findings with the Manager of Engineering Programs.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.04 Fire Protection Program Enhancements

Commitment 13 – “The Fire Protection Program will be enhanced to include additional inspection criteria for degradation of fire barrier walls, ceilings and floors, and specific fuel supply line inspection criteria for diesel driven fire pumps during tests. In addition, implementing surveillance procedures for halon and carbon dioxide suppression systems will specifically require inspection for corrosion, mechanical damage, or damage to dampers, and will include acceptance criteria stating that detected signs of corrosion or mechanical damage be evaluated, with corrective action taken as appropriate”.

a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures and associated work orders. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors noted the procedures used to inspect the relevant fire protection elements included the inspection criteria described in the commitment.

The inspectors noted that in one instance the implementing procedure did not specifically mirror the language in the commitment; however, the intent of the commitment was captured. The licensee entered this into their corrective action program (IR 1629936) as a potential enhancement.

Additionally, the inspectors noted that the commitment to inspect for corrosion and mechanical damage applies to the entire Halon™ and carbon dioxide suppression systems, including the tanks. The procedures that the licensee credited for implementation of this commitment did not have provisions to inspect the Cardox™ tank. Upon further review, it was determined that the existing procedure 1410-T-1, “Tank Inspection” satisfied this commitment.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.05 Fire Water System Program Enhancement

Commitment 14 – “The Fire Water System Program will be enhanced to include sprinkler head testing in accordance with NFPA 25, “Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.” Samples will be submitted to a testing laboratory prior to being in service 50 years. This testing will be repeated at intervals not exceeding 10 years. Prior to the period of extended operation, the program will be enhanced to include periodic non-intrusive wall thickness measurements of selected portions of the fire water system at an interval not to exceed every 10 years. The initial wall thickness inspections will be performed prior to the period of extended operation.”

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a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures, associated work orders and recurring tasks. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors verified that the required inspections have been completed. The inspectors also confirmed that recurring work orders exist to assure that future inspections will be completed on the required frequency.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.06 Reactor Vessel Surveillance Program Enhancements

a. Inspection Scope

Commitment 17 – “The reactor vessel surveillance program will be enhanced to address maintenance of the TMI-1 cavity dosimetry exchange schedule. The program will also be enhanced to clarify that, if future plant operations exceed the limitations or bound specified in Regulatory Position 1.3 of RG 1.99, Rev. 2, the impact of plant operations changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified.”

The inspectors reviewed AR 00603573 Action Request, Dated 1/8/2008, originally issued to track all the commitments made for Three Island Station Unit 1 License Renewal.

The inspectors reviewed ER-AA-270, Revision 9, and “Reactor Coolant Pressure Boundary (RCPB) Integrity” and noted the Three Mile Island specific requirements. For example at 4.1.8 P-T Limits and LTOP Setpoints, at 8. A for pressure and temperature monitoring the procedure specifies “If future plant operations exceed the limitations or bounds specified in Regulatory Position 1.3 of Regulatory Guide 1.99, Rev 2, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified.”

The inspectors reviewed ER-AA-370, Revision 9, “Reactor Coolant Pressure Boundary (RCPB) Integrity”, 4.1.6 “Material Surveillance Document Description,” and noted a TMI specific requirement that “Cavity dosimetry is installed and is periodically exchanged and measured to monitor neutron fluence”.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

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.07 One -Time Program

Commitment 18 – “The One-Time Inspection Program [will be] used to provide reasonable assurance that an aging effect is not occurring, or that the aging effect is occurring slowly enough to not affect a components intended function during the period of extended operation, and therefore will not require additional aging management. The program will be credited for cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected, or (c) the characteristics of the aging effect include a long incubation period. This program will be used for the following: (1) To confirm the effectiveness of the Water Chemistry program to manage the loss of material, cracking and the reduction of heat transfer aging effects for steel, stainless steel, copper alloy, nickel alloy and aluminum alloy in treated water, steam and reactor coolant environments. (2) To confirm the effectiveness of the Fuel Oil Chemistry program to manage the loss of material aging effect for steel, stainless steel and copper alloy in a fuel oil environment. (3) To confirm the effectiveness of the Lubricating Oil Analysis program to manage the loss of material and the reduction of heat transfer aging effects for steel, stainless steel, copper alloy and aluminum alloy in a lubricating oil environment. (4) To confirm the loss of material aging effect is insignificant for stainless steel and copper alloy in an air/gas-wetted environment. Inspection methods will include visual examination or volumetric examinations. Acceptance criteria will be in accordance with industry guidelines, codes and standards. The One-Time Inspection program provides for the evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation. Should aging effects be detected, the program triggers actions to characterize the nature and extent of the aging effect and determines what subsequent monitoring is needed to ensure intended functions are maintained during the period of extended operation.”

a. Inspection Scope

The inspectors reviewed the program owner assessment, GALL revision guidance comparison and cumulative summary for the One-Time Inspection Program and interviewed the program owner and license renewal personnel. The inspectors reviewed ten non-destructive evaluations (primarily ultrasonic testing) of sampled components. The inspectors reviewed the condition report and associated engineering evaluation related to one inspection which had identified degradation; the evaluation determined that follow-up monitoring was unnecessary.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

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.08 Selective Leaching

Commitment 19 – “The Selective Leaching of Materials Program will be used to manage the loss of material due to selective leaching. The program includes inspection of a representative sample of susceptible components to determine if loss of material due to selective leaching is occurring. One-time inspections will include visual examinations, supplemented by hardness tests and other examinations, as required. If selective leaching is found, the condition will be evaluated to determine the need to expand inspection scope.”

a. Inspection Scope

The inspectors reviewed the site administrative program procedure and two implementing work orders, and interviewed the program owner and license renewal personnel. The inspectors reviewed the program owner assessment, GALL revision guidance comparison and cumulative summary for the selective leaching program and ten metallographic evaluation reports of sampled components. The licensee determined that selective leaching existed in gray cast iron components in raw water, treated water and soil environments. Based on these determinations the licensee was developing an ongoing program to monitor selective leaching by means of metallographic evaluations. The inspectors reviewed the condition reports and associated engineering evaluations related to the findings of selective leaching and the draft corporate selective leaching program procedure.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.09 External Surfaces Monitoring Program

Commitment 21 – “The External Surfaces Monitoring Program will be used to manage aging effects through visual inspection of external surfaces for evidence of hardening and loss of strength and loss of material. The program directs visual inspections that are performed during system walk downs. The program consists of periodic visual inspection of components such as piping, piping components, ducting and other components within the scope of license renewal. Visual inspections may be augmented by physical manipulation to detect hardening and loss of strength of elastomers.”

a. Inspection Scope

The inspectors reviewed the administrative procedure for External Surfaces Monitoring Program, summary of external surfaces inspections for Cycle 19, and marked-up plant drawings delineating the 64 areas for inspection. The inspectors interviewed the program engineer and applicable license renewal personnel, and accompanied the

engineer during an external surfaces inspection within the Reactor Building, 322' elevation on November 14, 2013. The inspectors reviewed the area inspection reports and associated condition reports for 5 external surface areas within the plant.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.10 Lubricating Oil Analysis Program

Commitment 23 – “The Lubricating Oil Analysis Program is being implemented.”

a. Inspection Scope

The inspectors reviewed the administrative procedures for the predictive maintenance and lubrication programs, and three implementing procedures for oil sampling and analysis, and interviewed the lubrication engineer (program owner) and applicable license renewal personnel. The inspectors reviewed data within the corporate and vendor lubrication oil database software programs, including oil analysis results (latest and recent history) for five plant components. The inspectors reviewed a self-assessment, benchmarking report and condition report related to the lubrication oil program.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.11 ASME Section XI, Subsection IWE Program

Commitment 24 – “The ASME Section XI, Subsection IWE Program is being implemented.”

a. Inspection Scope

The inspectors reviewed the supporting documents and discussed the scope and implementation of this project to verify the satisfactory completion and fulfillment of this commitment.

The inspectors determined that the licensee's ASME Section XI, Subsection IWE, aging management program was an existing program based on ASME Code and complied with the provisions of 10 CFR 50.55a.

The program consists of periodic inspection of the reactor building liner plate, including its integral attachments, penetration sleeves, pressure retaining bolting, personnel airlock and equipment hatch, seals, gaskets, and moisture barrier, and other pressure retaining components for loss of material (general, pitting, and crevice corrosion), loss of pressure retaining bolting preload, cracking due to cyclic loading, loss of sealing, leakage through containment/deterioration of seals, gaskets and moisture barriers (caulking, flashing and other sealants).

Examination methods include visual and volumetric testing as required by ASME Section XI, Subsection IWE. Observed conditions that have the potential for impacting an intended function are evaluated for acceptability in accordance with ASME requirements, or corrected in accordance with the licensee's corrective action process.

To verify the technical adequacy and effective procedural control of implementation, the inspector reviewed the implementing procedures (NDE, corrective action, and documentation) and determined that they met the regulatory and Code requirements.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.12 ASME Section XI, Subsection IWL Program

Commitment 25 – "The ASME Section XI, Subsection IWL Program is being implemented."

a. Inspection Scope

The inspectors reviewed the supporting documents and discussed the scope and implementation of this project to verify the satisfactory completion and fulfillment of this commitment.

The inspectors determined that the Applicant's ASME Section XI, Subsection IWL, aging management program was an existing program based on ASME Code and complied with the provisions of 10 CFR 50.55a.

The program consists of periodic inspection/examination of reactor building concrete structures/components to verify their conformance to design functions and operability.

After the Once-Through Steam Generators were replaced in T1R18, an augmented reactor building In-Service Inspection was performed in 2010 as a one year follow-up inspection for the repair/replacement activities creating and closing a containment opening. Topical Report 204 documents the work performed and the inspection results. Inspection results met the requirements of ASME Section XI, Subsection IWL.

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By review of relevant documentation and discussions with technical personnel, the inspectors determined that the applicant's current containment program interval was based on the Section XI of the 1992 Edition with 1992 Addenda of ASME Code. This edition of code does not mandate a follow-up inspection/examination of containment structure following a repair. However, the 2001 Edition, with Addenda, of the Code and later Editions require augmented surveillance of concrete containment structures or pre-stressing system after a repair or replacement.

The inspectors verified that the licensee performed an augmented surveillance in accordance with the requirements of the 2004 of the Code (with no Addenda).

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.13 ASME Section XI, Subsection IWF Program

Commitment 26 – “The ASME Section XI, Subsection IWF Program is being implemented.”

a. Inspection Scope

The inspectors reviewed the supporting documents and discussed the scope and implementation of this project to verify the satisfactory completion and fulfillment of this commitment.

The inspectors determined that the licensee's ASME Section XI, Subsection IWL, aging management program was an existing program based on ASME Code and complied with the provisions of 10 CFR 50.55a. The purpose of this program is to conduct activities that are necessary to fulfill the requirements of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, as mandated by Title 10, *Code of Federal Regulations*, Part 50, Article 55a, “Codes and Standards” for the Inservice Inspection of systems and components that are classified as American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI Code Class 1, 2, 3, MC, and CC. (CM-1, CM-2, CM-3, CM-4, CM-5, CM-6).

To verify the program's compliance with the Code, technical adequacy and effectiveness of implementation, the inspectors reviewed documents, including program description, implementing procedures, test, surveillance and examination procedures and results of such inspection, tests and examinations. The inspectors also held discussions with engineering and management personnel to assess their awareness and oversight of the program implementation.

The inspectors verified that the IWF program was in-place, and was effectively implemented. Engineering and management personnel were cognizant of the program and effective oversight was exercised.

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b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.14 Structural Monitoring Program

Commitment 28 – “Existing program is credited. The program will be enhanced to include:

1. Service Building
2. UPS Diesel Building
3. Mechanical Draft Cooling Tower Structure
4. Miscellaneous Yard Structures: Storm Drainage and Flood Control Structure, including the structural platform; Duct banks; Manholes; Foundations for Condensate Storage Tank, Borated Water Storage Tank including the Borated Water Storage Tank Tunnel, Altitude Tank and Emergency Diesel Fuel Oil Storage Tank
5. Penetration seals which perform a license renewal intended function for an in-scope structure
6. Monitoring of the intake canal for loss of material and loss of form
7. Monitoring of electrical panels, junction boxes, instrument panels and conduits for loss of material due to corrosion
8. Monitoring of ground water chemistry by periodically sampling, testing and analysis of ground water to confirm that the environment remains non- aggressive for buried reinforced concrete
9. Monitoring of reinforced concrete submerged in raw water associated with intake screen and pump house, circulating water pump house, mechanical draft cooling tower structures, natural draft cooling tower basins and circulating water tunnel
10. Monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF, for reduction or loss of isolation function
11. Monitoring of HVAC duct supports for loss of material
12. Parameters monitored will be enhanced to include plausible aging effects and mechanisms
13. Monitoring of concrete structures for a reduction in anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking, and spalling
14. Revised acceptance criteria to provide details specified in ACI 349.3R-96.”

a. Inspection Scope

The inspectors reviewed the supporting documents and discussed the expanded scope and implementation of this project to verify the satisfactory completion and fulfillment of this commitment. Commitments were specified in Three Mile Island License Renewal

Program Basis Document, TMI 1 LR Action Tracking Item AR 603573.28, TM-PBD AMP-B.2.1.28, Structures Monitoring Program, in accordance with 10 CFR 54, Requirements for Renewal of Operating License for Nuclear Power Plants (CM-1). The project was intended to provide an approach to systematically evaluate plant structures and components, such that effectiveness of a structural maintenance program can be demonstrated. This program defines and implements periodic inspections and structural evaluations to ensure timely identification, assessment and corrective action for degraded structural elements.

The inspectors reviewed documents, held discussions with engineering and management personnel to verify the committed enhancements to the structural monitoring program. Additionally, the inspectors performed a walk-through inspection and examination of selected yard structures to verify the status of these structures within the structural monitoring program. Also, the structural monitoring program document was reviewed to verify that the scope was revised to include additional structures as committed by the licensee, and the acceptance criteria had been revised.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.15 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Commitment 30 – “The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be used to manage aging of non-EQ cables and connections during the period of extended operation. A representative sample of accessible cables and connections located in adverse localized environments will be visually inspected at least once every 10 years for indications of accelerated insulation aging such as embrittlement, discoloration, cracking, or surface contamination. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable or connection.”

a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures, associated work orders and recurring tasks. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors reviewed the licensee’s process for determining the representative sample of cables and verified that the required visual inspections have been completed. The inspectors also confirmed that recurring work orders exist to assure that future visual inspections will be completed on the required frequency.

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b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.16 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Commitment 31 – “The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will be enhanced to manage the aging of the cable and connection insulation of the in scope radiation monitoring and nuclear instrumentation circuits in the Radiation Monitoring and Nuclear Instrumentation and Incore Monitoring Systems. The in scope radiation monitoring and nuclear instrumentation circuits are sensitive instrumentation circuits with low-level signals and are located in areas where the cables and connections could be exposed to adverse localized environments caused by heat, radiation, or moisture. These adverse localized environments can result in reduced insulation resistance causing increases in leakage currents. Calibration testing and performance monitoring are currently being performed for in scope radiation monitoring circuits. Direct cable testing will be performed as an enhancement to ensure that the cable and connection insulation resistance is adequate for the nuclear instrumentation circuits to perform their intended functions.”

a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures and associated work orders. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors verified that the licensee's procedures and work orders have been updated to incorporate direct cable testing for the nuclear instruments. The inspectors reviewed completed work orders and noted that the licensee took appropriate corrective actions in response to any deficiencies identified by the testing.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented at there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.18 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Commitment 32 – “The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements will be used to manage the aging effects and mechanisms of non-EQ, in scope inaccessible medium voltage cables. These cables may at times be exposed to significant moisture simultaneously with

significant voltage. The TMI-1 cables in the scope of this aging management program will be tested using a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P.1-2, or other testing that is state-of-the-art at the time the test is performed. The cables will be tested at least once every 10 years. Manholes associated with the cables included in this aging management program will be inspected for water collection initially at least twice a year, in accordance with existing practices, and drained as required. The frequency will be adjusted based on inspection results recognizing that the objective of the inspections, as a preventive action, is to keep the cables infrequently submerged, thereby minimizing their exposure to significant moisture. The maximum time between inspections will be two years, which is in alignment with the recommended frequency in NUREG-1801, AMP XI.E3.”

a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures, associated work orders and recurring tasks. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors verified that the licensee’s cable testing methodology met the criteria in the license renewal commitment. The inspectors also confirmed that recurring tasks are scheduled such that the cables will be tested on intervals not to exceed ten years. The inspectors also reviewed the licensee’s manhole inspection procedures. The inspectors reviewed the scheduled frequency of the manhole inspections as well as past completed work orders and determined that the implementation is in accordance with the commitment.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.17 Metal Enclosed Bus Program

Commitment 33 – “The Metal Enclosed Bus Program will be enhanced to include the following inspection criteria:

1. The internal portion of the metal enclosed bus will be visually inspected for cracks, corrosion, foreign debris, excessive dust build-up and evidence of moisture intrusion.
2. The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling or discoloration, which may indicate overheating or aging degradation.
3. The internal bus supports will be visually inspected for structural integrity and signs of cracks. The program will also be enhanced to perform internal visual inspections on the 480V Metal Enclosed Bus and the Station Black Out Metal Enclosed Bus.”

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a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures and associated work orders. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors verified that the implementing procedures incorporate the inspection criteria described by the commitment. The inspectors also confirmed that visual inspections of the 480V Metal Enclosed Bus and the Station Black Out Metal Enclosed Bus have been incorporated into the program.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.18 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Commitment 34 – “The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be used to manage the aging effects of metallic parts of non-EQ electrical cable connections within the scope of license renewal during the period of extended operation. A representative sample of non-EQ electrical cable connections will be selected for one-time testing considering application (medium and low voltage), circuit loading (high loading) and location, with respect to connection stressors. The technical basis for the sample selected is to be documented. The specific type of test performed will be a proven test for detecting loose connections, such as thermography or contact resistance measurement, as appropriate to the application.”

a. Inspection Scope

The inspectors reviewed the license renewal application, safety evaluation report, implementation procedures and associated work orders. The inspectors discussed this commitment with applicable plant staff and license renewal personnel. The inspectors verified that the licensee chose an appropriate sample of non-EQ electrical cable connections for inclusion into this one-time testing program. The inspectors also verified that the licensee conducted an appropriate proven test. The inspectors confirmed that the results of the one-time testing demonstrated that the existing thermography program was effective.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.19 Nickel Alloy Aging Management Program

Commitment 35 – “The Nickel Alloy Aging Management Program will implement applicable Bulletins, Generic Letters, and staff- accepted industry guidelines.”

a. Inspection Scope

The Nickel Alloy Aging Management Program is an existing program that manages cracking due to primary water stress corrosion cracking of nickel alloy components. The Nickel Alloy Aging Management Program implements the inspection of components through an augmented In-service Inspection program. The augmented program administers component evaluations, examination methods, scheduling and site documentation as required to comply with regulatory, code or industry commitments related to Nickel Alloy issues. The inspectors verified the program implements Materials Reliability Program MRP-126, Generic Guidance for Alloy 600 Management which lists, in Appendix H, the applicable NRC regulatory vehicles (Information Notices, Bulletins, Generic Letters, etc.) applicable to the management of Alloy 600 degradation.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.20 Metal Fatigue of Reactor Coolant Pressure Boundary Program

Commitment 37 – “The Metal Fatigue of Reactor Coolant Pressure Boundary Program will be enhanced to add the statement: “Acceptable corrective actions include: reanalysis of the component to demonstrate that the design code limit will not be exceeded prior to or during the period of extended operation; repair of the component; replacement of the component, or other methods approved by the NRC.” In addition, the program will be enhanced to require a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit.”

a. Inspection Scope

The inspectors noted the Metal Fatigue of Reactor Coolant Pressure Boundary Program enforces corrective actions if the cumulative cycle counts of any transient approaches either 80% of the design cycle limit or 80% of the administrative cycle limit. The inspectors verified the plant fatigue monitoring procedure provides detailed design

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transient definitions that characterize each monitored design transient event and that Control Room Operators review the monitored data during the logging of a transient in accordance with the plant fatigue monitoring procedures to confirm that the tracked events do not produce stresses greater than those produced by the design transients. The fatigue monitoring procedure requires the fatigue monitoring engineer to review the plant operating logs semi-annually and whenever an unusual reactor operating event occurs that would require abnormal coolant injections. Plant logs and instrument data from the plant computer are used to assure that the actual transients have been appropriately characterized and are bounded by the design transients.

The inspectors verified that if the plant process parameters (P, T and Flow rates) are not bounded by a design basis transient, or if any tracked transient approaches 80% of its design cycle limit, the fatigue monitoring engineer is required to notify the Engineering Program Manager and initiate an engineering evaluation of the condition to determine if corrective action is required.

The inspectors verified the Updated Final Safety Analysis statement that "Prior to the period of extended operation, the program will be enhanced to add the statement: "Acceptable corrective actions include: reanalysis of the component to demonstrate that the design code limit will not be exceeded prior to or during the period of extended operation; repair the component; replace the component; or other methods approved by the NRC."

The inspectors reviewed ECR TM 14-0095 000 which implements the design change request to revise the UFSAR to include license renewal related information. The inspectors reviewed ER-AA-470, Revision 6, "Fatigue and Transient Monitoring Program", noting in paragraph 5.2.1 the requirement, if any component analysis approaching CUF of 1, to "review other reactor coolant pressure boundary fatigue analysis" to determine if they would exceed 1.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.21 Environmental Qualification of Electrical Components

Commitment 39 – "The Environmental Qualification of Electrical Components program is being implemented."

a. Inspection Scope

The purpose of the Environmental Qualification (EQ) Program is to provide assurance that specific electrical equipment within the scope of the program will perform its intended function. The inspectors reviewed a sample of implementing procedures, quarterly health reports and self-assessments to determine that the program is being adequately implemented.

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b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.

.22 New Once Through Steam Generators

Commitment 40 – “New Once-Through Steam Generators will be installed.”

a. Inspection Scope

10 CFR 54.22 requires a license renewal application include changes or additions to the technical specifications necessary to manage aging effects during the period of extended operation. In the original application Amergen N/K/A Exelon committed to replace their once-through-steam-generators prior to the beginning of the extended period of operation. This commitment was made in order to align the proposed aging management programs for steam generators with the new generators, obviating the need to propose aging management programs for steam generators that would be replaced prior to the extended period of operation. The replacement generators would require a technical specification change request.

The generators were replaced during the refueling outage ending January 2010. The inspectors reviewed "Technical Specification Change Request No. 343, dated October 9, 2008. This request proposed eliminating the existing requirements associated with tube sleeve repairs and application of the alternate repair criteria. The amendment proposed incorporating a revised primary-to-secondary leakage criteria, changed the period required for reporting steam generator and incorporated revised tube integrity surveillance frequency requirements for Alloy 690 tubing.

b. Findings

No findings were identified. The inspectors concluded the commitment is being implemented and there is reasonable assurance the effects of aging will be managed during the extended period of operation.



**4. OTHER ACTIVITIES [OA]****4OA6 Meetings, Including Exit****Exit Meeting Summary**

The team presented their preliminary inspection results to Mr. Richard Libra, Three Mile Island Nuclear Station, Site Vice President, and other members of the site staff at a debrief meeting on March 7, 2014. The team further discussed their preliminary inspection results to Mr. Mark Torborg, Three Mile Island Nuclear Station, Engineering Programs Manager and other members of the site staff an exit meeting on February 21, 2014. No proprietary information was included in this inspection report.

Attachment: Supplemental Information

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## KEY POINTS OF CONTACT

### Licensee Personnel

R. Libra, Site Vice President  
M. Newcomer, Plant Manager  
D. Atherholt, Manager, Regulatory Assurance  
K. Coughlin, Operations SOS  
J. Dullinger, Director, Site Engineering  
M. Fitzwater, Licensing Engineer  
E. Shawalter, Design Engineer  
C. Six, Director, Site Operations  
D. Trastle, NOS  
M. Torborg, Manager, Engineering Programs  
M. Willenbecher, Manager, Operations Support

### NRC Personnel

M. Gray, Chief, Engineering Branch 1, Division of Reactor Safety  
D. Werkheiser, Senior Resident Inspector, Three Mile Island Nuclear Station  
J. Heinly, Resident Inspector, Three Mile Island Nuclear Station

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

None

### Opened and Closed

None

### Closed

None

### Discussed

None

## LIST OF DOCUMENTS REVIEWED

### Results Binders

Fire Protection Results Book, AMP – B.2.1.13

Fire Water System Results Book, AMP – B.2.1.14

Electrical Cables & Connections Not Subject to 10 CFR 50.49

Environmental Qualifications Requirements Results Book, AMP – B.2.1.30

Electrical Cables & Connections Not Subject to 10 CFR 50.49

Environmental Qualification Requirements Used in Instrumentation Circuits Results Book,  
AMP – B.2.1.31

Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification  
Requirements Results Book, AMP – B.2.1.32

Metal Enclosed Bus Results Book, AMP – B.2.1.33

Electrical Cable Connections Not Subject to 10 CFR 50.49

Environmental Qualification Requirements Results Book, AMP – B.2.1.34

Environmental Qualification (EQ) of Electrical Components Results Book, AMP – B.3.1.03

### Work Orders (WOs)

R2130922

### IRs

1629936\*

\*written as a result of this inspection

### Procedures:

1410-T-1, "Tank Inspection," Revision 22

ER-AP-420, Steam Generator Management Program

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

ER-AP-420-008, TMI Unit 1: Steam Generator Secondary Side Visual Inspections

ER-AP-420-0051, Conduct of Steam Generator Management Program Activities

ER-AA-330, Rev. 10; Conduct of Inservice Inspection Activities

ER-AA-330-007, Rev. 009; Visual Examination of ASME Section XI Class MC and  
Class CC Surfaces

ER-AA-330-009, Rev. 007; ASME Section XI Repair / Replacement Program

ER-TM-450, Revision 2, TMI STRUCTURES MONITORING PROGRAM

(Including attachments, procedures, work-orders, and commitment documents)

ER-AP-330-1001, Revision 2, Alloy 600 Management Plan

ER-AA-330-002, Revision 11, INSERVICE INSPECTION OF SECTION XI WELDS  
AND COMPONENTS

ER-AP-335-001, Rev 003, BARE METAL VISUAL EXAMINATION FOR  
ALLOY 600-82-182 MATERIALS

ER-AA-4001, Rev 004, MATERIALS DEGRADATION MANAGEMENT PROCESS  
(MDMP) IMPLEMENTATION GUIDANCE

ER-AA-330, Rev 010, CONDUCT OF INSERVICE INSPECTION ACTIVITIES

CY-AP-120-1005, Primary Strategic Water Chemistry Plan for Once-Through Steam Generator

CY-AP-120-2005, Secondary Strategic Water Chemistry Plan for Once-Through  
Steam Generator

Miscellaneous

TMI-1-ISI-Basis-5, Rev. 5; First Interval 10 Year Inservice Inspection Program ISI, IWE/IWL  
TMIUNIT 1 OUTAGE T1R19 STEAM GENERATOR DEGRADATION ASSESSMENT  
AREVA EIR 51-9172250-00 "Condition Monitoring and Operational Assessment of TMI-1  
Steam Generators at 1R19  
Technical Evaluation 1557595-01 T1R20 Steam Generator Degradation Assessment T1R20 DA  
10/22/13  
AREVA 51-9124284-001 "LBLOCA-EOTSG Degraded Tube Assessment  
AREVA 32-9075183-002 "TMI NEI 97-06 Degraded Tube Analysis"  
TMI-ISI-BASIS-INT3-3, ISI Selection Document, Third Ten-year Inspection Interval, 10/19/2010  
TMI04.G05, ISI Selection Document, Fourth Ten-Year Inspection Interval, 02/16/2012  
TMI04.G03, Rev. 2; Three Mile Island Nuclear Station Unit 1 ISI Program Plan for  
Fourth Ten-Year Inspection Interval  
TMI04.G05, Three Mile Island Nuclear Station Unit 1 ISI Selection Document Fourth  
Ten-Year Inspection Interval  
TMI 5th 10 Year Interval ISI Plan  
TMI 5th 10 Year Interval ISI Selection Document  
TMI 6th 10 Year Interval ISI Plan  
TMI 6th 10 Year Interval ISI Selection Document  
Implementing Work Orders Indexed by AR 603573.xx.xx  
C2020603, A2191021, Perform Reactor Building Containment Liner Repairs  
(Pages 1-10 in book and 1061 pages in electronic file)  
C2020506, A2191027, Install Inspection Plugs/Ports in Reactor Building Basement  
Floor for Periodic Corrosion Monitoring of Containment Liner Below the Moisture Barrier  
Completed Work Orders Indexed by AR 603573.xx.xx  
C2020603, A2191021, Perform Reactor Building Containment Liner Repairs  
UA-1, Rev. 16, Structural Facility Inspection  
C2020506, A2191027, Install Inspection Plugs/Ports in Reactor Building Basement  
Floor for Periodic Corrosion Monitoring of Containment Liner Below the Moisture Barrier  
C2018823, Inspection Port UT and VT NDE Reports  
Outage T1R19 IWE NDE Reports  
Outage T1R20 IWE NDE Reports  
TMI-1-ISI-Basis-5, First Interval 10 Year Inservice Inspection Program ISI, IWE/IWL  
Topical Report 203, Rev. 0; 35<sup>th</sup> Year Reactor Building Tendon Surveillance (Period 9)

**LIST OF ACRONYMS**

AB	Auxiliary Building
AC	Alternating Current
ADAMS	Agencywide Documents Access and Management System
APCSB	Auxiliary and Power Conversion Systems Branch
BTP	Branch Technical Position
BWST	Borated Water Storage Tank
CAP	Corrective Action Program
CFR	Code of Federal Regulations
DC	Direct Current
DH	Decay Heat
DRP	Division of Reactor Projects
DRS	Division of Reactor Safety
ECR	Engineering Change Request
EDG	Emergency Diesel Generator
Elev.	Elevation
ESAS	Engineered Safeguards Actuation System
FA	Fire Area
FHAR	Fire Hazards Analysis Report
FPP	Fire Protection Program
FSSD	Post-Fire Safe Shutdown
FZ	Fire Zone
GL	Generic Letter
HPI	High Pressure Injection
IN	[NRC] Information Notice
IMC	[NRC] Inspection Manual Chapter
IP	[NRC] Inspection Procedure
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination of External Events
IR	Issue Report
IR	[NRC] Inspection Report
JPM	Job Performance Measure
LPI	Low Pressure Injection
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NOS	Nuclear Over-Site
NRC	Nuclear Regulatory Commission
NRR	[NRC] Nuclear Reactor Regulation

PARS	Publicly Available Records System
P&ID	Piping and Instrumentation Drawing
RCP	Reactor Coolant Pump
RG	[NRC] Regulatory Guide
RSP	Remote Shutdown Panel
SE	[NRC] Safety Evaluation
SER	[NRC] Safety Evaluation Report
SG	Steam Generator
TCP	Transient Combustible Permit
TMI	Three Mile Island
UFSAR	Updated Final Safety Analysis Report