UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, ILLINOIS 60532-4352

January 31, 2020

EA-19-097

Mr. Peter Dietrich, Senior VP
and Chief Nuclear Officer
DTE Energy Company
Fermi 2 – 260 TAC
6400 North Dixie Highway
Newport, MI 48166

SUBJECT: FERMI POWER PLANT, UNIT 2 – SPECIAL INSPECTION REACTIVE REPORT 05000341/2019050

Dear Mr. Dietrich:

On July 2, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed its initial assessment of degraded torus coatings and the potential for torus suction strainer blockage, which was identified on May 29, 2019 at Fermi Power Plant, Unit 2. Based on this initial assessment, the NRC sent an inspection team to your site on July 10, 2019.

On January 14, 2020, the NRC completed its special inspection and discussed the results of this inspection with Mr. Matthew Kirschenheiter and other members of your staff. The results of this inspection are documented in the enclosed report.

Two findings of very low safety significance (Green) are documented in this report. These findings involved violations of NRC requirements. We are treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violations or the significance or severity of the violations documented in this inspection report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region III; the Director, Office of Enforcement; and the NRC Resident Inspector at Fermi Power Plant, Unit 2.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region III; and the NRC Resident Inspector at Fermi Power Plant, Unit 2.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA by Kenneth O'Brien Acting for/

Mohammed A. Shuaibi, Deputy Director
Division of Reactor Projects

Docket No. 05000341
License No. NPF-43

Enclosures:
Special Inspection Report
05000341/2019050
Special Inspection Team Charter

cc w/ encl: Distribution via LISTSERV®

Letter to Peter Dietrich from Mohammed Shuaibi dated January 31, 2020.

SUBJECT: FERMI POWER PLANT, UNIT 2 – SPECIAL INSPECTION REACTIVE REPORT 05000341/2019050

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number:	05000341
License Number:	NPF-43
Report Number:	05000341/2019050
Enterprise Identifier:	I-2019-050-0000
Licensee:	DTE Electric Company
Facility:	Fermi Power Plant, Unit 2
Location:	Newport, MI
Inspection Dates:	July 10, 2019 to October 31, 2019
Inspectors:	A. Chereskin, Chemical Engineer N. Feliz-Adorno, Senior Reactor Inspector J. Gavula, Mechanical Engineer M. Jones, Reactor Inspector S. Smith, Senior Safety And Plant Systems Eng M. Yoder, Senior Chemical Engineer
Approved By:	Karla K. Stoedter, Chief Engineering Branch 2 Division of Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a special inspection at Fermi Power Plant, Unit 2, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information.

List of Findings and Violations

Failure to Identify the Degrading Condition of the Improperly Cured Torus Coating as a Condition Adverse to Quality Requiring Corrective Actions			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000341/2019050-01 Open/Closed	[H.13] - Consistent Process	93812
A finding of very low safety significance (Green) and an associated non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Actions," was identified by the inspectors for the licensee's failure to identify the degrading condition of the improperly cured torus coating as a condition adverse to quality requiring corrective actions on multiple occasions since at least 1994. As a result, the licensee also failed to correct this condition adverse to quality.			

Failure to Establish a Test Program that Demonstrates the Improperly Cured Torus Coating Will Perform Satisfactorily in Service			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000341/2019050-02 Open/Closed	[P.1] - Identification	93812
A finding of very low safety significance (Green) and an associated non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," was identified by the inspectors for the licensee's failure to establish a test program that demonstrated the improperly cured torus coating would perform satisfactorily in service. Specifically, the licensee's inspection procedures did not contain acceptance criteria to evaluate the coating inspection results and demonstrate the acceptability of the improperly cured torus coating.			

Additional Tracking Items

None.

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

93812 - Special Inspection Team

In accordance with the attached Special Inspection Team (SIT) Charter, the inspection team conducted a detailed review of the potential torus strainer blockage issue discovered on May 29, 2019. As detailed in the SIT Charter, the following items were reviewed:

1. Establish a sequence of events related to the installation, monitoring, evaluation, and repair of torus coatings since the construction of Fermi Nuclear Power Plant, Unit 2. This would include dates and, when relevant, times for the installation and acceptance of the initial torus coating and recoating, subsequent coating inspections, disposition of coating inspection issues including repairs, and any occurrence having the potential to challenge the suction strainer debris loading. This would also include dates for submittals to the NRC involving torus coatings as it relates to suction strainer performance or license renewal.
2. Review the licensee's evaluations of the potential degraded torus coating impact to the functionality of safety systems. This would include the licensee's acceptance of the degraded torus coating areas identified during coating inspections and the licensee's recent evaluations performed in response to the associated 2019 Design Bases Assurance Inspection (DBAI) Team questions. This review would also consider the aggregate effects of other unresolved challenges to the suction strainers such as the issues identified by the 2016 Component Design Basis Inspection Team, which were documented in Inspection Report 05000341/2016007.
3. Review the licensee's maintenance of the torus coating condition. This may include procedures and practices used during coating monitoring, evaluation, and repair. This may also include a review of vendor and/or manufacturer literature.
4. Review the effectiveness of the licensee's Corrective Action Program at addressing internal and recent (since 2010) external operating experience involving torus coatings and suction strainer blockage issues.

INSPECTION RESULTS

Assessment	93812

Charter Item #1 - Sequence of Events

Summary:

In 1989, during Fermi's first refueling outage (RF), licensee contractors inspected the torus coating and discovered "severe blistering" of all coatings between 4 to 8 o'clock of the torus bottom. An adhesion test was performed showing "poor" adhesion of the affected coatings. The contractor's coating consultant completed a torus coating suitability review on behalf of the licensee and found the blisters formed because of solvent entrapment due to lack of forced heat curing following coating application. The review concluded the coating "…is now stable, and spontaneous rupture of blisters and/or protective coating delamination will not occur under normal or accident conditions." The review also stated, "The condition of the blistered protective coating in the Fermi suppression pool should be periodically monitored to further verify that no dynamic failure mechanisms are present."

On October 31, 1989, the licensee issued a letter to the NRC summarizing the results of the torus coating suitability review. The letter stated the licensee would monitor the coatings to detect any coating changes and evaluate the results to accept the coatings or make repairs, as appropriate. On June 25, 1991, the NRC replied to the licensee in a letter stating the NRC staff found the torus coatings acceptable.

To monitor the coatings, the licensee established one square foot test areas and inspection procedures to periodically record coating blister size and density. The licensee initially inspected these test areas during every other refueling outage beginning with the second refueling outage. The inspection frequency was variable between 2007 and 2017 and then changed to every outage after 2017. The licensee's monitoring and repair activities were focused on ensuring the coatings were effective at protecting the torus from corrosion but were not focused on verifying that no dynamic coating failure mechanisms were present (as indicated by the licensee's contractor during the SIT).

On May 29, 2019, the NRC Design Basis Assurance Inspection (DBAI) raised questions regarding the condition of the torus coatings and potential impacts on the licensee's ability to ensure adequate net positive suction head (NPSH) to multiple safety (e.g., ECCS and torus cooling system) pumps following a design basis accident. On July 10, 2019, an NRC SIT was dispatched to follow up on the DBAI's torus coating concerns.

Detailed Sequence of Events:

Pre-startup. The torus immersion region was coated with Plasite 7155. The coating at the torus bottom invert was subsequently replaced due to construction damage. The torus was filled with water shortly after completing the coating repair.

08/28/1984. Fermi issued a letter titled "Coatings Inside Containment," to the NRC, which transmitted report DECO-12-2191, "Evaluation of Containment Coatings." This report stated the torus coatings have been applied in full compliance with the provisions of NRC Regulatory Guide 1.54 and American National Standards Institute (ANSI) 101.4 (1972). The torus coating was described as "qualified and safety related."

03/20/1985. Fermi, Unit 2 Operating License Issued.

01/23/1988. Fermi begins commercial operation at power.

1989 (RF01). A contractor inspected the torus coating on behalf of the licensee. The coating inspection report documented “severe blistering” of all coatings between 4 o'clock to 8 o'clock of the torus bottom. The blistered condition was captured in the Corrective Action Program as DER 89-1093. The licensee established one square foot test areas to periodically inspect changes in blister conditions (i.e., monitor for changes in blister density and size). The report also stated, “There is loss of coating adhesion in blistered areas...” and described the coating adhesion in 14 of the 16 torus bays as “poor” or “very poor."

10/12/1989. A contractor completed a coating suitability review titled, “Evaluation of Protective Coating Blisters Suppression Pool Interior Protective Coating,” on behalf of the licensee. This review concluded the cause of the blistered condition was solvent entrapment due to improper coating curing. The review also accepted the coating condition and recommended periodic monitoring of the blistered coatings to verify that no dynamic failure mechanisms were present. The SIT assessment of Charter Item 2 discusses the content of this review in more detail.

10/31/1989. Fermi submitted a letter titled, “Results of Inspections and Repairs of Primary Containment/Torus Coating During First Refueling Outage,” to the NRC summarizing the results of the blistered torus coating suitability review. The letter also stated the licensee would monitor the coatings by comparing new photos of selected areas with the original photos to detect any changes in the blistered condition and evaluate the results to accept the coatings or make repairs, as appropriate.

1991 (RF02). The torus coating inspection report documented no significant changes in coating integrity when compared to RF01. The report recommended that future inspections include a quantitative adhesion test program designed to monitor changes in coating adhesion properties over time.

06/25/1991. The NRC issued letter “Primary Containment Torus Coating Inspection at Fermi-2 (TAC No. 77692)” to the licensee in response to the licensee’s 1989 letter. It stated, “…the staff finds the Primary Containment Torus Coatings at Fermi-2 are acceptable...”

1994 (RF04). The coating inspection report stated, “No significant changes in coating integrity were identified when compared to results of inspections performed during RF01 and RF02; however, the blistered condition of the coating in the bottom invert is slightly worse than RF02.” Two of four test areas showed an increase in maximum blister diameter and a decrease in the number of blisters per square inch.

1998 (RF06). The coating inspection report documented a 1 to 8 percent increase in the total number of blisters in each test area since RF04. It also stated, “Blister sizes have remained static over the three-year period, with only negligible growth.” The residual heat removal (RHR) system and core spray (CS) suction strainers were replaced with an improved design in response to NRC Bulletin 96-03, “Potential Plugging of ECCS Strainers by Debris in Boiling Water Reactors.”

2001 (RF08). The coating inspection report trend showed an increase in the total number of blisters in each test area.

2004 (RF10). The coating inspection report stated, “Analysis of inspection results from RF04 to RF10 indicates a 1 to 11 percent increase in the total number of blisters in each evaluation area.” The report also stated “…the brittleness of these blisters and general adhesion of this coating must be considered.”

2007 (RF12). The coating inspection report trend showed an increase in the total number of blisters in each test area. The report recommended considering brittleness and general adhesion of the coating.

2009 (RF13). The coating inspection report documented that one test area showed a sharp decrease in the number of blisters. The trends of the other test areas showed a progressive increase in the number of blisters. The licensee’s qualified coating inspectors noted it was difficult to determine the cause. The report also recommended considering brittleness and general adhesion of the coating.

2012 (RF15). The coating inspection report stated “…minor growth in the size or population density of the blisters has been noted over the past ten years (a progressive condition).” It documented a decrease in blister number and postulated it was due to blisters starting to blend into each other. It also recommended finding several new evaluation areas to monitor in addition to the existing monitoring areas. Corrective action document CARD 12-28374 was generated to track blistered protective coatings as a margin management item due to the potential effects on torus corrosion protection. The potential for strainer blockage was not considered.

04/24/2014. Fermi submitted its license renewal application which included a discussion of aging management programs involving torus coatings.

10/01/2014. Corrective action document CARD 14-27772 evaluated the impact of deferring torus coating inspections and repairs from RF17 to RF18. It also discussed the submittal of a torus recoat proposal in a licensee long-range plan with a tentative implementation date of 2026.

12/2016. The NRC issued the Safety Evaluation Report for Fermi’s License Renewal Application (ML16356A234) which included aging management programs for torus coatings.

03/10/2017. The licensee completed a torus coating suitability review titled “Evaluation of Fermi 2 Blister Torus Wetted (Immersion) Region Substrate Coatings.” It concluded the torus blistered coating was stable and made recommendations such as the performance of adhesion testing.

2017 (RF18). The coating inspection report documented embrittlement and changes in blister size and density. It also stated that the coating, “…can, in the worst-case areas, be forced to delaminate with leverage of a putty knife…” Inspection videos showed the discovery of an area of coating delamination. The final repair size was 36 inches by 78 inches. Corrective action document CARD 17-22973 captured the discoveries, but operability during at-power operations was not evaluated. The report recommended an aggressive and larger scale coating repair and increasing the coating inspection frequency to every refueling outage.

2018 (RF19). The coating inspection report documented that the torus coatings were more brittle and had larger delaminated areas than in past inspections. It stated, “Torus coating conditions are dynamic." It also stated, "In the worst-case areas, coating between blisters can be removed by light hand scraping using a putty knife."

05/29/2019. The NRC DBAI team raised questions regarding the condition of the torus coatings and its potential impact on the licensee's ability to ensure NPSH to multiple safety (e.g., ECCS and torus cooling system) pumps following a design basis accident.

07/10/2019. An NRC SIT was dispatched to follow up on the DBAI's torus coating concerns.

To date, the licensee has performed 11 torus coating inspections. Nine of these inspections identified torus coating embrittlement and/or changes in torus coating blister size or density. These observations were not documented in the licensee's Corrective Action Program for seven of these inspections and no evaluation was provided to the SIT to demonstrate the licensee had verified that no dynamic coating failure mechanisms were present. In addition, 5 of 11 coating inspection reports, and the most recent coating suitability review, recommended performing coating adhesion testing, evaluating changes in coating brittleness, or performing aggressive and larger scale coating repair. These recommendations, made by the licensee's qualified coating consultants, were not implemented by the licensee.

Assessment	93812

Charter Item #2 - Torus Coating Evaluations

The SIT determined the licensee's evaluations performed since discovering the improperly cured torus coating in RF01 contained conclusions which were not always well supported (i.e., contained conclusions and theories which conflicted with information contained in the periodic coating inspection reports and/or videos; introduced information that was contradictory of the evaluation's conclusions; and/or contained unsubstantiated assumptions). The inspectors determined that licensee evaluations performed prior to the 2019 NRC inspections were primarily focused on the ability of the coatings to provide corrosion protection for the torus. The evaluations did not consider the potential for increased torus suction strainer plugging and decreased net positive suction head to safety systems due to the degraded coating condition.

During the SIT, the licensee completed an operability evaluation and concluded all safety systems remained operable. The SIT reviewed this evaluation and disagreed with the licensee's conclusion based upon the multiple examples of issues discussed in more detail in this section of the inspection report. The SIT discussed these aspects with various levels of Region III management including the Regional Administrator (RA) and Deputy Regional Administrator (DRA). Due to the complex nature of issues identified by the SIT and the uncertainties associated with parameters and assumptions contained in the operability evaluation, the RA and DRA did not conclude that a sufficiently large area of coatings would delaminate and plug the strainers following a design basis accident to the extent that functionality/operability of safety systems was lost. Therefore, the RA and DRA concluded there was not sufficient justification to challenge the licensee's operability conclusion. The RA and DRA conclusion is discussed in more detail in the Assessment section titled "Regional Administrator Office Final Decision."

<u>Torus Coating Evaluation Performed Around the 1989 Discovery of Torus Coating Blisters</u>

The SIT determined that the licensee's torus coating evaluations performed around the 1989 discovery of torus coating blisters either consistently conflicted with, or did not address, the licensee’s periodic coating inspection results. For example, the October 12, 1989, coating suitability review concluded, “Based upon physical and photographic data collected by the SGPAI Dive Team [i.e., the RF01 qualified coating inspectors], the protective coating is now stable, and spontaneous rupture of blisters and/or protective coating delamination will not occur under normal or accident conditions.” The suitability review also acknowledged that the licensee’s qualified coating inspectors performed knife adhesion tests. However, the SIT noted the suitability review did not address the loss of coating adhesion discovered during the RF01 coating inspection even though the associated coating inspection report, “Interior Protective Coating, Suppression Chamber Underwater Desludging, Inspection and Repair,” stated, “There is loss of coating adhesion in blistered areas...” and described the coating adhesion in 14 of the 16 torus bays as “poor” or “very poor.” The licensee was unable to provide information regarding why the coating adhesion assessment was not addressed in the suitability review.

Similarly, the SIT determined that information provided by the licensee to the NRC about the torus coating condition discovered in 1989 did not fully discuss the licensee’s coating inspection results. Specifically, the licensee submitted a letter to the NRC titled “Results of Inspections and Repairs of Primary Containment/Torus Coating During First Refueling Outage,” on October 31, 1989. This letter summarized the results of the 1989 suitability review and described the 1989 coating inspection. However, it did not discuss the discovery of “loss of coating adhesion” or make any reference to the “poor” or “very poor” adhesion results documented in the 1989 coating inspection report. The licensee was unable to provide information regarding why the coating adhesion inspection results were not discussed in their 1989 letter to the NRC.

The SIT also noted that the NRC’s response to the licensee’s letter did not appear to fully address all of the licensee’s coating inspection results. Specifically, on June 25, 1991, the NRC issued letter “Primary Containment Torus Coating Inspection at Fermi-2 (TAC No. 77692)” to the licensee stating, “…the staff finds the Primary Containment Torus Coatings at Fermi-2 are acceptable...” This letter closed TAC No. 77692 related to NRC concerns raised by the staff at the time of licensing in 1985, which predates the discovery of the improperly cured torus coating. Because this NRC’s position stated in the letter was made approximately 30 years ago, the SIT was unable to follow up with the NRC staff involved with the review of the licensee’s letter to determine whether this staff position accepted the improperly cured torus coating or was intended to only address the 1985 concerns. Similarly, the SIT was unable to determine the actions the NRC staff may have taken had they received detailed information on all of the coating inspection results at that time. As a result, no further regulatory action was determined to be appropriate given the age and lack of details regarding these events. In addition, efforts to clarify the details were not needed to support an assessment of the recent licensee performance or to provide reasonable assurance of adequate protection.

<u>Torus Coating Re-Evaluation Performed Prior to the 2019 NRC DBAI</u>

The improperly cured torus coating condition was re-evaluated in 2017 through the performance of a new suitability review titled, “Evaluation of Fermi 2 Blister Torus Wetted (Immersion) Region Substrate Coatings,” dated March 10, 2017. Within this suitability review the licensee concluded, “Periodic inspections performed since 1989 have found that the coating system is stable and integral. Blisters are found intact, are hard and not brittle, coating is solid and can be ruptured only by deliberate force.” However, based on the timeline contained in the assessment of Charter Item 1, the SIT determined that the periodic torus coating inspection reports documented torus coating observations that were indicative of unstable conditions since at least 1994 and pronounced trend changes in blister size and density since 2009. This same coating suitability review also stated, “Since the 2017 torus immersion coatings inspection should provide significant findings toward continued Plasite 7155 system integrity acceptability, it is recommended that this evaluation be updated as torus immersion area coatings inspection findings from the upcoming refueling outage are determined.” The SIT reviewed the licensee’s 2017 and 2018 torus coating inspection reports and noted the licensee’s qualified coating inspectors found embrittlement and dynamic conditions of the improperly cured torus coating area. The licensee had not evaluated these results against the acceptance criterion contained in the 1989 suitability review of “no dynamic failure mechanism are present.” In addition, the licensee had not revised the 2017 suitability review to include and evaluate the conflicting 2017 and 2018 torus coating inspection results.

<u>Torus Coating Evaluations Performed in Response to the 2019 DBAI Team’s Questions</u>

The SIT reviewed two evaluations of the torus coating condition performed in response to the 2019 DBAI Team’s questions. Within Evaluation 0021-0056-LTR-001, “Evaluation of Internal Coating Integrity,” Revision 2, the licensee concluded the improperly cured torus coating retained adequate adhesion strength based upon the results of adhesion tests performed on a coating at a different nuclear power plant. The inspectors reviewed this evaluation and found that the licensee had concluded the coating type and degradation mode present at this different nuclear power plant was representative of the Fermi torus coating type and condition. The SIT disagreed with the licensee’s conclusion because the coating adhesion test results at the different nuclear power plant failed to meet the adhesion strength acceptance criteria contained by reference in Section 6.2.1.6 of Fermi’s Updated Final Safety Analysis Report (UFSAR). Specifically, the coating at the other nuclear power plant showed adhesion values from 37 to 135 pounds per square inch (psi) while the Fermi UFSAR imposed an adhesion strength of at least 200 psi. In addition, an adhesion test performed on Fermi’s torus coating in 1989 found “poor adhesion” as documented in the licensee’s RF01 coating inspection report.

The licensee also performed Evaluation 1900679.401, “Fermi-2 2019 DBAI Degraded Torus Coatings Assessment on Emergency Core Cooling System (ECCS) Performance,” Revision 0, to determine the available RHR and CS suction strainer head loss margin. The licensee completed this evaluation using a non-limiting pipe break scenario. The evaluation also considered high energy pipe breaks downstream of a main steam isolation valve (MSIV) with an assumption that the MSIV rapidly closed isolating the break and preventing debris generation. The SIT reviewed this evaluation and determined it could not be used to demonstrate the ability of the suction strainers to perform their function following a postulated accident. The non-limiting pipe break scenarios generated less fibrous debris than would be generated during limiting scenarios. As a result, the licensee’s analyzed condition did not represent the worst postulated accident scenario the licensee was required to mitigate by their licensing basis. With regards to the pipe break downstream of the MSIV, the inspectors agreed that the MSIV would close and isolate the break. However, a short period of time would elapse between the pipe break occurring and the MSIV receiving a signal to close which would allow some debris generation to occur. The licensee had not determined the amount of debris generated prior to the MSIV fully closing.

Operability Evaluation Performed During the SIT

The licensee captured the SIT's concerns regarding the coating evaluations performed in response to the 2019 DBAI Team's questions in the Corrective Action Program as CARD 19-25301 and performed operability evaluation EFA-T23-19-006 which concluded the affected safety systems (i.e., RHR and CS) remained operable. The SIT concluded the EFA conflicted with previous coating inspection reports and videos, used assumptions that were not technically supported, and portions of the EFA information and assumptions did not support the licensee's overall conclusion. The SIT also found that specific numerical information or assumptions documented in the EFA were underestimated and that a very small change in any of these variables would challenge the licensee's operability conclusion. The following were examples of issues raised by the SIT:

1. Relationship between coating swelling/osmotic pressure (i.e., water entering through the semipermeable coating) and the variation in blister count

   During the DBAI and SIT inspections, the licensee provided several reasons to explain why changes in coating blister size and density occurred. Initially, the licensee indicated the coating blister count was changing due to coating aging. When the SIT questioned the licensee regarding the coating acceptability, the licensee revised their position and concluded the coating blister size and density varied due to osmotic pressure. The SIT noted the licensee's operability evaluation had not provided evidence supporting that water molecule permeation was occurring. The evaluation also failed to consider and rule out any other degradation mechanism that may be occurring. The SIT noted that the occurrence of osmotic pressure could be contributing to changes in blister density due to blisters merging (e.g., adjacent blisters growing and combining into a single larger blister) and the creation of new blisters. The SIT determined that if the osmotic pressure theory was correct, the actual number of new blisters was likely higher than suggested in the licensee's blister density data. The magnitude of the new blister generation rate could not be determined since the total blister count was also affected by the merging of blisters. The SIT noted that coating inspection reports often documented increasing blister density and sizes.

2. Relationship between osmotic pressure and coating adhesion and cohesion

   The licensee's operability evaluation indicated that the improperly cured torus coating was acceptable because the cause of the blister density and size changes were due to osmotic pressure. The SIT reviewed hours of coating inspection videos and the supporting torus coating inspection reports which caused them to question the overall coating stability, adhesion, and cohesion. In addition, the American Society for Metals (ASM) Handbook, Volume 05B, "Protective Organic Coatings," Section 41.2.2.2 states, "The swelling caused by the coating film can separate polar bonds and other weak forces holding the molecule together and to the substrate such that polar attractions, so necessary to coating film adhesion/cohesion, no longer occur." Based on this statement by the ASM, osmotically induced swelling adversely impacts both adhesion and cohesion. As a result, the SIT concluded that, if the licensee's osmotic theory was correct, it would validate the SIT's concern that the coating adhesion and cohesion properties were degraded.

3. Comparison of safety relief valve lift event conditions to loss of coolant accident (LOCA) conditions and application of Plant Unique Analysis Report data

Within the operability evaluation, the licensee stated that two actual safety relief valve (SRV) lift events, which occurred in 2003 and 2015, resulted in forces at the torus coating surface (e.g., resulting from pressure oscillations, flow velocities, and jet loading) that were "similar if not greater than those same types of forces during a DBA LOCA." The licensee based its comparison of SRV lift conditions to LOCA conditions on information contained in Plant Unique Analysis Report (PUAR) DET-04-028-1 which evaluated the torus structural capabilities under various scenarios. The licensee concluded that since the two SRV lift events had resulted in little to no change in coating damage, and the temperatures and stress values predicted by the PUAR methodology during SRV lift events were believed to exceed the torus temperatures and stress values during LOCA events, the improperly cured torus coating would remain adhered to the substrate during a design basis accident.

The SIT reviewed the PUAR methodology and concluded that applying these methods to compare SRV lift conditions to LOCA conditions, in the context of evaluating torus coating integrity and transport, was not appropriate. The PUAR methodology was intended to be conservative for structural integrity evaluations only. In addition, the PUAR methodology was designed to predict much higher torus temperature and stress values than expected to ensure torus structural integrity was maintained. The SIT determined the licensee misapplied the PUAR methodology because the predicted temperature and stress values overestimated the temperature and stresses experienced during plant specific testing and actual SRV lift events. Specifically,

- In letter DET-22-103, "Submittal of Safety Relief Valve In-Plant Testing Results," dated September 11, 1987, the licensee informed the NRC that plant specific testing showed torus temperature and stress values following an SRV lift were well below the values predicted using the PUAR methodology. The SIT also noted the SRV sparger diffuser nozzles direct the jets in a manner that avoided jet impingement during these events. This would suggest that the forces experienced during an SRV lift event were not of sufficient magnitude to reach the torus coating surface and cause delamination. The SIT viewed a recent coating repair video which showed the water pressure caused by a rotary tool operating near the coating surface was sufficient to detach degraded torus coating. Therefore, the SIT expected the forces experienced during a post-LOCA blowdown to be of sufficient magnitude to cause torus coating delamination.

- The licensee's operability evaluation stated the maximum local torus temperature associated with an SRV lift would be 202°F and compared it against a LOCA maximum bulk torus temperature of about 196.5°F. As a reference, Revision 22 of UFSAR Section 6.3.2.14 stated, "In general, local-to-bulk temperature differences at the time of maximum temperatures are about 15°F for cases where two RHR loops are assumed available and about 30°F for cases where one RHR loop is assumed available." However, the SIT noted that,

    - Letter DET-22-103 stated the actual temperature measured during SRV lift testing was 106°F. Letter DET-22-103 did not specify whether the 106°F value was a local or bulk torus temperature. In any case, the SIT noted it was considerably less than the LOCA maximum bulk torus temperature of 196.5°F.

- The PUAR stated the 202°F value is the highest possible local water temperature adjacent to the SRV and is calculated to assure thermohydraulic stability within the torus. The SIT determined this PUAR temperature value was not representative of the torus shell temperature where the coating is located due to the distance between the SRV and the torus shell and the volume of water contained in this area.

- The corrective action documents associated with the SRV lift events (i.e., CARD 15-26472 and CARD 03-19948) stated the maximum average torus water temperature for the events were 87°F and 101.8°F for 2015 and 2003 events respectively, which was significantly less than the LOCA maximum bulk pool temperature value used by the licensee's operability evaluation and demonstrated that the SRV lift conditions did not bound the expected LOCA conditions.

The SIT presented this information to the licensee. The licensee continued to base its comparison of SRV lift conditions to LOCA conditions on information contained in DET-04-028-1 and did not resolve the items highlighted by the SIT.

4. Improperly cured torus coating surface area

During the inspection, the team reviewed documents which described the total surface area of the improperly cured torus coating in one of three ways: 1) approximately 7,000 square feet; 2) an area from approximately the 4 o'clock to 8 o'clock position on the torus; and 3) an arc which begins at the torus bottom and extends 12 feet up in each direction. Documentation sent by the licensee to the NRC in 1989 described the improperly cured torus coating area as provided in description #2 above. The SIT noted that description #3 was based on dimensions recorded by the licensee's qualified coating specialists on torus drawings during coating inspection activities. The inspectors were also provided information indicating none of the three descriptions accounted for the improperly cured torus coatings present on non-pressure boundary components such as the torus ring girders, T-quencher support pipe, ram heads, and ram head bottom plates.

The inspectors noted the licensee's operability evaluation used the 7,000 square feet value to describe the amount of improperly cured torus coating and to determine a torus coating debris mass generation value. The inspectors were concerned by the licensee's use of the 7,000 square feet value because actual geometric calculations performed by the SIT based upon descriptions #2 and #3 (and including the ring girder surface area) resulted in surface area values of approximately 14,000 square feet and 11,000 square feet respectively. The licensee was unable to provide information necessary to estimate the amount of coatings on the remaining non-pressure boundary components. The licensee was also unable to provide a basis for the 7,000 square feet value. The SIT noted the surface area value obtained using description #2 would exceed the licensee's operability threshold. In addition, a five percent increase of the surface area value obtained using description #3 would exceed the licensee's operability threshold. Thus, the SIT determined the unaccounted surface area of the non-pressure boundary components would likely challenge the licensee's operability evaluation conclusion using the surface area value obtained using description #3. The SIT presented this information to the licensee to demonstrate the uncertainty in the surface area value and the need to use a more realistic value. The licensee continued to use the 7,000 square feet value and did not resolve the items highlighted by the SIT.

5. Debris mass generation

   The SIT noted the operability evaluation assumed approximately 19 percent of the improperly cured torus coating would detach during a design basis accident. This torus coating debris mass generation value was based on two methods. In the first method, the licensee assumed the torus coating debris was generated from fractured blisters since all improperly cured unblistered coating and blisters that were not fractured were assumed to be firmly adhered. The coating area assumed to detach following a design basis accident was based on the average coating repair size for a broken blister. The second method assumed the torus bays containing large-size, high-density blisters would fail 100 percent of their coatings while the rest of the bays would not fail any of their coatings. This resulted in only 3 out of 16 torus bays generating coating debris.

   The SIT determined the licensee's methods described above conflicted with the information contained in the licensee's torus coating inspection reports and underestimated the torus coating debris mass generation values. The SIT determined the licensee's torus coating inspection results showed that poor adhesion was present independent of the presence of fractured blisters. The torus coating repair videos also showed coating with potentially poor adhesion that was not fully removed before repairs were made suggesting that the licensee's use of average repair size may not be sufficient to account for all coating that could fail during a design basis accident. The SIT concluded the licensee's assumption that only 3 out of 16 torus bays generated coating debris significantly conflicted with the torus coating inspection reports going back to RF01. For example, the RF01 torus coating inspection report noted "poor" to "very poor" adhesion in all bays except bays 2 and 14. In contrast, the licensee's method assumed only three bays failed, including bay 2. The SIT also determined the percentage of torus coating assumed by the license to detach would only need to increase by an additional one percent to exceed the licensee's operability threshold. The SIT presented this information to the licensee to demonstrate the uncertainty in their debris mass generation value. The licensee continued to use the two methodologies described above and did not resolve the items highlighted by the SIT.

6. Transport analysis assumption on coating debris size distribution

   The licensee performed two coating debris size distribution analyses. Each analysis assumed the detached coatings would break up into one of three sizes: fines (pieces less than 0.125 inches in size), small chips (pieces 0.125 to 0.5 inches in size), and large chips (pieces 0.5 to 2.0 inches in size). A higher fraction of "fines" coating debris would lead to a higher fraction of coatings debris being transported to the strainers and could result in a higher probability of suction strainer plugging and safety-related pump failure if the fines occurred in conjunction with fibrous debris accumulation on the strainers. "Small chips" would lead to a lower fraction of coatings debris being transported to the strainers but could challenge the function of the suction strainers even in the absence of fibrous debris because this chip size was larger than the strainer flow holes.

One of the licensee's distribution analyses divided the size of broken blisters discovered during previous repair activities by a factor of two to account for coating brittleness. The licensee provided no basis to explain why dividing the size of the broken blisters by a factor of two appropriately accounted for the observed coating brittleness. This resulted in a coating size distribution of 42.6 percent fines, 55.7 percent small chips, and 1.75 percent large chips. The SIT questioned this size distribution because the results conflicted with torus coating inspection reports which stated, "the torus coating debris has become brittle and breaks up into fine particulate when vacuumed." For example, the RF18 torus desludging report stated most broken blister caps were not found in the desludging pump strainer baskets but, instead, were found in the filter banks as the debris essentially became "a fine constituent of the torus sludge." As a result, the SIT determined the percentage of fines was likely higher than assumed in this size distribution, which would result in a higher transport factor than used in the licensee's operability evaluation.

The licensee's second torus coating debris size distribution (49.51 percent fines, 9.43 percent small chips, and 41.06 percent large chips) was equivalent to the size distribution of a coating tested at a different nuclear power plant. Although the tested coating was an epoxy coating like Fermi's, the tested epoxy differed because it was properly cured and only detached because the primer was applied improperly and failed. The tested epoxy also exhibited no known flaws or deficiencies in and of itself. In contrast, Fermi's torus coating degradation was solely within the epoxy itself as it was improperly cured. Lastly, the tested epoxy was in a pressurized water reactor containment and had not experienced immersion service. In contrast, the improperly cured torus coating at Fermi had been submerged for approximately 30 years, and the licensee believed it was experiencing osmotic pressure degradation. Based upon this information, the SIT concluded it was not appropriate to assume that Fermi's brittle epoxy coating would perform like the tested epoxy. In addition, the SIT found no evidence from previous coating inspection reports to support the assumption of 41.06 percent large chips. The SIT believes it would be more appropriate to assume Fermi's epoxy would generate more fines and/or small chips than the tested epoxy, and that this would result in a greater transport factor than used in the licensee's operability evaluation.

The SIT performed a sensitivity analysis and determined a transport factor increase of five percent would exceed the licensee's operability threshold. The SIT presented this information to the licensee to demonstrate the uncertainty in their transport factor value. The licensee continued to use the two methodologies described above and did not resolve the items highlighted by the SIT.

7. Head loss analysis assumptions

The licensee's operability evaluation did not evaluate scenarios which resulted in creating strainer debris beds thinner than 0.125 inches. However, the SIT noted that this scenario screening threshold value was not supported by the source document referenced by Fermi's operability evaluation. Specifically, the operability evaluation referenced a test which used a thinner bed (i.e., 0.09 inches). The SIT also noted the 0.125 inch threshold value was inconsistent with previous NRC and industry positions. Specifically, the NRC and the Nuclear Energy Institute agreed that a debris bed thickness threshold of 0.0625 inches was appropriate (ML120730181). The SIT presented this information to the licensee. No information was provided to the SIT to explain why the 0.125-inch screening threshold continued to be used in the licensee's operability evaluation.

8. Coating delamination discovered in 2017

   In 2017, the licensee's qualified coating inspectors identified two coating cracks in bay 2 next to a ring girder. Subsequent examination revealed the cracks were associated with delaminated coatings. The final coating repair size was approximately 19.5 square feet. The operability evaluation concluded that localized mechanical damage resulted in cracks which allowed water ingress and led to substrate (i.e., metal) corrosion and coating delamination. The source of mechanical damage was attributed to maintenance activities performed during refueling outages (e.g., desludging, ladders, tools).

   The SIT was concerned that if the licensee's mechanical damage theory was correct other coating areas would be vulnerable to delamination because they also experience periodic maintenance activities assumed to have caused the mechanical damage. In addition, the operability evaluation indicated that one crack was found at the junction of a ring girder and a ridge in the coating and stated this location was "…more difficult to coat initially…," and areas such as this "…can be more susceptible to overcoat or dry coat." If correct, this would indicate that other similar coating areas could be vulnerable to cracking, water ingress, substrate corrosion and coating delamination.

   The SIT concluded that, while localized mechanical damage may chip away a coating piece at the point of contact, it would not affect the adhesion of a larger, acceptable coating area. If the areas surrounding the initial crack were tightly adhered, then water would not be able to permeate it and cause corrosion and subsequent loss of adhesion over such a large area. Therefore, the SIT determined mechanical damage was likely not the cause of the coating delamination discovered in 2017. However, if the licensee's mechanical damage explanation and the previously discussed osmotic pressure theory are correct, it would imply that the improperly cured coating is susceptible to water ingress and subsequent loss of adhesion in all areas with water-filled blisters.

9. Prior industry operating experience

   In 2018, the licensee performed a proactive repair on an area of coating determined to be acceptable for continued service. The area repaired measured approximately 16 square feet. The licensee used information from the repair to gain insights on the production rate, tools, and resources needed to perform a large-scale coating repair. The operability evaluation concluded the completion of the proactive repair demonstrated that large portions of the improperly cured torus coating maintained good cohesion and adhesion. This conclusion was based upon the fact that the coating was removed by qualified coating specialists using powered rotary tools and various manual scraping tools, and the licensee's belief that these methods required significant effort to remove the coating.

   The SIT reviewed videos of the proactive repair and noticed portions of the coating being removed with a variety of manual tools including a pocket knife and a putty knife. The SIT was concerned the removal of coatings using these tools alone may not be acceptable to demonstrate the remaining improperly cured torus coating would maintain good cohesion and adhesion. During an SIT at a different nuclear plant related to degraded torus coatings (ML15050A653), qualified coating specialists used putty knives to scrape the torus coating until these specialists believed an acceptable coating layer was reached. However, this “acceptable” coating layer failed subsequent adhesion tests using the pull-off method and the same adhesion strength acceptance criterion value incorporated by reference in Fermi’s UFSAR Section 6.2.1.6. Ultimately, the different nuclear plant removed the coating deemed “acceptable” using high-pressure water sprays (i.e., power washing) accounting for about 70 percent of the total unacceptable coating material removed. This indicates the forces applied by manual scraping alone was not sufficient to ensure that all unacceptable coating was removed prior to performing repairs. Based upon this information, the SIT believed that portions of the remaining torus coating at Fermi were not likely to have good cohesion and adhesion. The SIT was also concerned about the licensee’s decision to use information from the proactive repair to assess the overall material condition of all improperly cured torus coating which had not undergone adhesion testing since 1989.

Based on the information above, the SIT concluded the licensee had not provided reasonable assurance of continued operability. For perspective, the SIT performed a sensitivity analysis of the licensee’s evaluation and showed that the licensee’s operability threshold would be exceeded when using the surface area value based on description #2 as discussed in item #4 above. Alternatively, a change of 5 percent in any one factor (i.e., estimated coating degraded area, percentage of coating detachment, and transport factor) would challenge the licensee’s operability threshold assuming the surface area obtained using description #3 as discussed in item #4 above.

Assessment	93812

Charter Item #3 - Maintenance of Torus Coating

The SIT reviewed the coating suitability reviews, torus coating inspection reports and videos, and coating inspection procedures in effect since 1989. The SIT determined the licensee’s program and procedures for monitoring, evaluating, and repairing the torus coating were not appropriate for managing the condition of the improperly cured torus coating. For example, the licensee’s 1989 coating suitability review stated, “The condition of the blistered protective coating in the Fermi suppression pool should be periodically monitored to further verify that no dynamic failure mechanisms are present.” To accomplish this, the licensee established one square foot test areas and recorded the blister size and density during periodic inspections. The SIT found that the inspection procedures used by the licensee to monitor these areas did not contain acceptance criteria to evaluate the test results for dynamic failure mechanisms. The licensee captured this issue in their Corrective Action Program as CARD 19-25339.

The SIT also found that the program and procedures required coating repairs to be performed only after all three coating layers were broken exposing the torus metal walls to the corrosive (i.e., water) environment and the metal was exhibiting corrosion. Maintenance records show that the repairs made since 1989 account for less than 3 percent of the improperly cured torus coating (using the 7,000 square feet value the licensee’s operability evaluation used to describe the amount of improperly cured torus coating). Through a review of coating repair videos and licensee data, the SIT found that the most recent average coating repair size of 6.27 square inches was much larger than the blister size range of 0.003 to 0.049 inches. The

SIT determined this indicated that portions of the coating surrounding the blisters was not tightly adhered and degradation was not limited to the blisters themselves.

The SIT also noted that multiple coating inspection reports completed between 1991 and 2017, and the 2017 coating suitability review, provided recommendations that appeared to address the torus coating inspection results. These recommendations included performing coating adhesion testing, evaluating changes in coating brittleness, or performing aggressive and larger scale coating repairs. When the SIT asked for the basis for rejecting the testing recommendations the licensee stated, "The site has not elected [sic] to perform quantitative testing at this time as it is not a requirement of the site's license commitments and the qualitative inspection results have continued to classify the coating as acceptable." As stated earlier, the SIT found the qualitative inspection results were not evaluated. The licensee implemented a recent recommendation to increase the coating inspection and broken blister repair frequency to every refueling outage beginning with the 2017 refueling outage. The SIT found that the inspection frequency change only increased the data collection and repair of broken blisters with corrosion; this change did not result in an evaluation of the coating's material condition or performing aggressive and larger-scale coating repairs. The licensee initiated corrective action document CARD 19-25292 during this special inspection to assess the vendor recommendations documented in previous coating inspections.

Assessment	93812

Charter Item #4 - Corrective Actions

The SIT reviewed corrective action documents addressing torus coating and suction strainer blockage issues since 1989. The SIT determined the licensee failed to identify the improperly cured torus coating condition was a condition adverse to quality requiring corrective actions on multiple occasions since 1989. As a result, the licensee also failed to correct this condition adverse to quality. Notable examples included:

- The licensee's qualified coating inspectors examined the torus coating during the discovery of the blistered coating condition in 1989 and found loss of coating adhesion. For example, the coating inspection report stated that "There is loss of coating adhesion in blistered areas..." and the coating adhesion in all but 2 of the 16 bays was "poor" or "very poor." However, the licensee failed to identify this condition was a condition adverse to quality requiring corrective actions and, as a result, also failed to correct it.

- The licensee's periodic torus coating inspection reports documented torus coating observations that were indicative of unstable conditions (i.e., changes in blister size and density) since at least 1994, pronounced trend changes in blister size and density since 2009, and coating embrittlement since 2017. The most recent inspection report (i.e., 2018) stated, "Torus coating conditions are dynamic" and "In the worst-case areas, coating between blisters can be removed by light hand scraping using a putty knife." However, the licensee failed to identify these conditions were contrary to the basis for accepting the improperly cured torus coating and indicative of degraded coating adhesion, which was a condition adverse to quality requiring corrective actions. For example, the 1989 and 2017 coating suitability reviews determined the improperly cured torus coating would not block the ECCS strainers because its condition was, in part, "stable" and "not brittle." As a result, the licensee also failed to correct the condition adverse to quality.

In addition, the SIT observed examples of issues that were not thoroughly evaluated by the licensee. These examples included:

- The corrective action document associated with the 1989 discovery of blistered coating (i.e., DER 89-1093) stated, "…based on a review of knife test, blisters will not come off during accident conditions." However, the SIT noted this evaluation conflicted with information contained in the 1989 coating inspection report. The report stated, "There is loss of coating adhesion in blistered areas..." and described the coating adhesion in all but 2 of the 16 bays as "poor" or "very poor." With respect to the knife test results, the report stated, "Adhesion is poor." The licensee was unable to provide information regarding why corrective action document DER 89-1093 conflicted with the 1989 inspection report.

- The licensee's periodic torus coating inspection reports documented torus coating observations that were indicative of degrading conditions since at least 1994. However, the deteriorating torus coating condition was not captured in the Corrective Action Program and evaluated for potential impact on torus suction strainer and ECCS operability until 2012. The licensee was unable to provide information regarding why the degrading coating inspection results were not evaluated to determine whether they were indicative of a condition adverse to quality requiring corrective actions.

- When the degrading condition of the improperly cured torus coating was captured in the Corrective Action Program in 2012 as CARD 12-28374, it was not adequately evaluated as a potential challenge to the continued operability of the torus suction strainers and the safety-related systems the strainers support. The licensee determined the coating was acceptable because it remained within the design analysis of UFSAR Table 6.2-8. However, this table did not contain an analysis for coating acceptance or any information that could be used to evaluate the condition found during the inspection. This table only contained general information such as coating type, location, thickness, and amount installed. The SIT presented this information to the licensee. The licensee was unable to explain the relevance of the information contained in UFSAR Table 6.2-8 when evaluating the operability impact of the coating condition described in CARD 12-28374.

- The licensee recognized the conditions identified in the torus coating inspections represented a potential impact to the ECCS suction strainers. Specifically, CARD 14-27772 written in 2014 stated:

  > "The probable cause for the decrease in the number of blisters, is that over time the blisters are starting to blend into each other, two blisters become one. Based off of [sic] the inspections, it appears that the blisters are growing in size. This has the potential to lessen the adhesion of the protective coating, resulting in a greater possibility of loss of base metal of the primary containment **and the greater possibility for the loss of coating affecting the ECCS suction strainers [emphasis added]**."

  During an interview of licensee personnel involved with the evaluation contained in this CARD, the personnel stated this issue was not treated as a problem or further evaluated within the Corrective Action Program due to the absence of specific acceptance criteria that would provide a clear indication they had an issue. The interviewed personnel were unable to explain their reason for not developing specific acceptance criteria. In addition, this CARD documented the licensee's decision to defer the planned torus coating inspections from RF17 to RF18 despite the licensee's assessment quoted above.

- CARD 17-22973 documented the discovery of dynamic coating conditions and a large section of damaged coatings. The licensee did not evaluate the operability of the suction strainers because the reactor was shut down at the time of discovery. However, the coating conditions were present at times when the reactor was operating. The licensee was unable to explain why operability when the reactor was operating was not evaluated.

- The 2018 coating inspection report documented that the torus coatings were more brittle and had larger delaminated areas than in past inspections. It stated, "Torus coating conditions are dynamic." It also stated, "In the worst-case areas, coating between blisters can be removed by light hand scraping using a putty knife." This discovery was not captured in the Corrective Action Program or evaluated as a potential condition adverse to quality requiring corrective actions. The licensee was unable to explain why this discovery was not evaluated to determine whether it was a condition adverse to quality.

The licensee initiated corrective action document CARD 19-25302 during this special inspection to improve the quality of their corrective action documents and evaluations contained therein.

The SIT also observed the licensee did not evaluate the 2014 operating experience involving torus coating delamination at another nuclear power plant. The licensee initiated corrective action documents CARD 19-25305 and CARD 19-25306 during this special inspection to review the external operating experience.

Assessment	93812

Regional Administrator Office Final Decision

The Region III RA and DRA evaluated the SIT's technical assessment and conclusion that the licensee had not provided reasonable assurance of operability. The RA and DRA agreed that many assumptions used by the licensee in their operability evaluation were overly-optimistic and were likely not bounding. The RA and DRA noted that many of these assumptions had a high degree of uncertainty. For example, while they agreed the licensee's SRV-lift argument may not be representative of a medium to large LOCA blowdown parameters, they determined the argument included information that provided uncertainty with some localized high-temperature and high-pressure water entering the torus: the coating (although maybe loosened) did not delaminate during the SRV-lift events. The RA and DRA also concluded that actual delamination/easily removed coating/repair of blisters are, so far, small in area; and that the SIT did not overcome the burden that rests with the NRC to show that larger area would, in fact, delaminate.

The RA and DRA also consulted with senior risk analysts (SRAs) who performed a risk analysis for the exposure time associated with operating the plant until the licensee's proposed target date for repairing the torus coating. Based on the SRAs' risk analysis, the amount of uncertainty associated with the licensee's operability evaluation, and the SIT's

conclusions, the RA and DRA determined the degrading torus coating condition warranted a Confirmatory Action Letter (CAL) to ensure the issue is corrected within the licensee's proposed schedule. The NRC Enforcement Policy defined a CAL as "…a letter confirming a licensee's, contractor's, or non-licensee's (subject to NRC jurisdiction) voluntary agreement to take certain actions to remove significant concerns about health and safety, safeguards, or the environment." On September 26, 2019, the licensee submitted a letter to the NRC documenting their commitment to recoat all of the submerged portion of the torus, including the internal components that are not part of the pressure boundary, beginning on, or before, April 30, 2020. On October 7, 2019, Region III issued a Confirmatory Action Letter to DTE Energy Company to confirm the licensee's commitment to recoat portions of the Fermi Unit 2 torus during the next planned refueling outage scheduled for Spring 2020. The Regional Administrator's decision regarding the licensee's operability assessment and issuance of a CAL did not negate the performance deficiencies and non-compliances discussed in this report.

Failure to Identify the Degrading Condition of the Improperly Cured Torus Coating as a Condition Adverse to Quality Requiring Corrective Actions			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000341/2019050-01 Open/Closed	[H.13] - Consistent Process	93812
A finding of very low safety significance (Green) and associated non-cited violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Actions," was identified by the inspectors for the licensee's failure to identify the degrading condition of the improperly cured torus coating as a condition adverse to quality requiring corrective actions on multiple occasions since at least 1994. As a result, the licensee also failed to correct this condition adverse to quality.			
Description: In 1989, during a planned refueling outage, a licensee contractor entered the torus and discovered severe blistering of all coatings between 4 o'clock to 8 o'clock of the bottom torus. The licensee's qualified coating inspectors documented their inspection results in a report titled "Interior Protective Coating, Suppression Chamber Underwater Desludging, Inspection and Repair." The licensee captured this discovery in corrective action document DER 89-1093. A licensee contractor completed a coating suitability review titled, "Evaluation of Protective Coating Blisters Suppression Pool Interior Protective Coating," which concluded the blisters were the result of solvent entrapment due to a lack of forced heat curing. Corrective action document DER 89-1093 stated "…based on a review of knife test, blisters will not come off during accident conditions." Similarly, the 1989 coating suitability review concluded, "Based upon physical and photographic data collected by the SGPAI Dive Team [i.e., the RF01 qualified coating inspectors], the protective coating is now stable, and spontaneous rupture of blisters and/or protective coating delamination will not occur under normal or accident conditions." However, the SIT noted these conclusions conflicted with the 1989 coating inspection report which stated, "There is loss of coating adhesion in blistered areas..." and described the coating adhesion in all but 2 of the 16 bays as "poor" or "very poor." In addition, a knife test (a type of adhesion test) was performed and videotaped by the			

licensee's qualified coating inspectors in bay 15 showing poor to questionable adhesion. Thus, the SIT determined the licensee failed to identify the improperly cured torus coating was not tightly adhered to its substrate, which was a condition adverse to quality requiring corrective actions. Consequently, the licensee also failed to correct this condition adverse to quality.

As discussed in more detail in the SIT assessment of Charter Item 2, the SIT also noted the licensee submitted a letter to the NRC following the 1989 coating inspection that did not fully discuss the licensee's torus coating inspection results. While the discovery, inspection, and evaluation of the improperly cured torus coating was discussed in the licensee's letter, the letter was intended to address concerns raised by the NRC staff prior to the discovery of the improperly cured torus coating. The NRC replied to the licensee's letter stating, "…the staff finds the Primary Containment Torus Coatings at Fermi-2 are acceptable..." Because the NRC's position stated in this reply was made approximately 30 years ago, the SIT was unable to follow up with the NRC staff involved with the review of the licensee's letter to determine whether the quoted staff position accepted the licensee's improperly cured coatings or was intended to only address the 1985 concerns. As a result, no further regulatory action was determined to be appropriate given the age and lack of details regarding these events. In addition, efforts to clarify the details were not needed to support an assessment of the recent licensee performance or to provide reasonable assurance of adequate protection. Specifically, the SIT found multiple examples dating back to 1994 where the licensee had not identified the improperly cured torus coating condition as progressively deteriorating as discussed below. The SIT concluded the corrective actions needed to address the more recent performance issues dispositioned by this NCV would address the concerns associated with the 1989 letter to the NRC failing to fully discuss the 1989 torus coating inspection results.

As shown by the timeline included in the SIT assessment of Charter Item 1, the licensee's periodic torus coating inspection reports documented torus coating observations that were indicative of unstable conditions (i.e., changes in blister size and density) since at least 1994, pronounced trend changes in blister size and density since 2009, and coating embrittlement since 2017. The most recent inspection report (i.e., 2018) stated, "Torus coating conditions are dynamic" and "In the worst-case areas, coating between blisters can be removed by light hand scraping using a putty knife." However, the licensee failed to identify these conditions were contrary to the basis for accepting the improperly cured torus coating and indicative of degraded coating adhesion. As discussed in the timeline, the 1989 and 2017 coating suitability reviews determined the improperly cured torus coating would not block the ECCS strainers because its condition was, in part, "stable" and "not brittle."

Corrective Actions: The licensee's proposed corrective action to restore compliance included recoating the torus during their next scheduled refueling outage. As an immediate action, the licensee performed operability evaluation EFA-T23-19-006, which concluded the RHR and CS systems remained operable.

Corrective Action References: CARD 19-25301 and CARD 20-20194

Performance Assessment:

Performance Deficiency: The inspectors determined that the failure to identify the degrading condition of the improperly cured torus coating as a condition adverse to quality and correct it was contrary to 10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions," and was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failure to identify and correct a condition adverse to quality affecting torus coating adhesion resulted in a condition where the RHR and CS suction strainer debris loading could not initially be reasonably assured to remain sufficiently low to support an adequate water supply to RHR and CS, which are accident mitigating systems.

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors used IMC 0609, Appendix A, Exhibit 2 and determined this finding was of very low safety significance (Green) because of the RA and DRA final conclusion that the SSCs maintained their operability or functionality in spite of the design or qualification issue identified.

Cross-Cutting Aspect: H.13 - Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. The SIT determined that this finding had a cross-cutting aspect in the area of Human Performance because individuals did not use a consistent, systematic approach to make decisions and incorporate risk insights as appropriate. Specifically, as shown in the SIT assessment of the Charter Items, the licensee did not recognize and manage the risk of the improperly cured torus coating to the ECCS suction strainer functionality from 1989 to as recently as the time of this inspection. This resulted in the failure to establish a consistent process to ensure the coating condition was effectively evaluated.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," states, in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and non-conformances, are promptly identified and corrected.

The licensee's torus coating suitability reviews conducted in 1989 and 2017 determined that the improperly cured torus coating would not block the ECCS strainers because the coating's condition was, in part, "stable" and "not brittle."

Contrary to the above, since at least 1994, the licensee failed to establish measures to promptly identify and correct conditions adverse to quality. Specifically, the licensee failed to identify periodic torus coating inspection results documenting torus coating observations that: 1) were indicative of unstable conditions since at least 1994; 2) included an increasing trend in blister size and density since 2009; and 3) identified coating embrittlement since 2017 as conditions adverse to quality requiring corrective actions.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

Failure to Establish a Test Program that Demonstrates the Improperly Cured Torus Coating Will Perform Satisfactorily in Service			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000341/2019050-02 Open/Closed	[P.1] - Identification	93812

A finding of very low safety significance (Green) and associated non-cited violation of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," was identified by the inspectors for the licensee's failure to establish a test program that demonstrated the improperly cured torus coating would perform satisfactorily in service. Specifically, the inspection procedures did not contain acceptance criteria to evaluate the coating inspection results and demonstrate the acceptability of the improperly cured torus coating.

<u>Description</u>:

In 1989, during a planned refueling outage, a licensee contractor entered the torus and discovered severe blistering of all coatings between 4 o'clock to 8 o'clock of the bottom torus. The licensee's qualified coating inspectors rated the blisters as American Society for Testing and Materials (ASTM) No. 4 to 6 medium dense and mostly intact. They also noted loss of coating adhesion in blistered areas. A knife test (a type of adhesion test) was performed and videotaped in bay 15 showing poor to questionable adhesion. The qualified coating inspectors recommended further monitoring of the coatings to ensure no dynamic failure mechanisms occurred. The condition was captured in the Corrective Action Program as DER 89-1093.

On October 12, 1989, the licensee contractor completed coating suitability review, "Evaluation of Protective Coating Blisters Suppression Pool Interior Protective Coating," which concluded the blisters were the result of solvent entrapment due to a lack of forced heat curing. It also concluded the coating was stable and spontaneous rupture of blisters and/or protective coating delamination would not occur under normal or accident conditions. The evaluation also stated, "The condition of the blistered protective coating in the Fermi suppression pool should be periodically monitored to further verify that no dynamic failure mechanisms are present." The inspectors' assessment of this evaluation is discussed in the assessment of Charter Item 2.

On October 31, 1989, the licensee issued a letter titled, "Results of Inspections and Repairs of Primary Containment/Torus Coating During First Refueling Outage," to the NRC summarizing the results of the improperly cured torus coating evaluation. The letter also stated the licensee would monitor the coatings to detect any coating changes and evaluate the results to accept the coatings or make repairs, as appropriate. On June 25, 1991, the NRC replied to the licensee in letter titled "Primary Containment Torus Coating Inspection at Fermi-2 (TAC No. 77692)." The NRC staff found the torus coatings acceptable based on the information provided by the licensee.

To monitor the coatings, the licensee established one square foot test areas and inspection procedures. At the time of the Special Inspection, these procedures were 43.000.019, "Primary Containment Inspection," Revision 9, and QCP-10-1, "Underwater Coating Inspection," Revision 3. The licensee periodically recorded coating blister size and density as shown in the timeline included in the assessment of Charter Item 1. However, these inspection results were not evaluated to demonstrate the coatings would not plug the ECCS suction strainers. The licensee's monitoring and repair activities were focused on ensuring the coatings were effective at protecting the torus from corrosion. For example, coating repairs were limited to broken blisters with corrosion of the exposed substrate.

In addition, the monitoring procedures did not contain acceptance criteria to verify that no dynamic failure mechanisms were present as stated in the 1989 coating suitability review. Notwithstanding this, since 1991, the licensee's qualified coating inspectors provided recommendations that appeared to address the inspection results such as recommending adhesion testing and large area repairs. However, the licensee chose to not implement these recommendations. This observation is discussed in more detail in the SIT assessment of Charter Item 3.

As discussed in the SIT assessment of Charter Item 4, the SIT determined that the periodic torus coating inspection reports documented torus coating observations that were indicative of unstable conditions since at least 1994 and pronounced trend changes in blister size and density since 2009.

Corrective Actions: The licensee's proposed corrective action to restore compliance included revising procedures to include inspection acceptance criteria. As an immediate action, the licensee performed operability evaluation EFA-T23-19-006, which concluded the RHR and CS systems remained operable.

Corrective Action References: CARD 19-25301 and CARD 19-25339

Performance Assessment:

Performance Deficiency: The inspectors determined that the failure to establish a test program that demonstrates the improperly cured torus coating will perform satisfactorily in service was contrary to 10 CFR 50, Appendix B, Criterion XI, "Test Control," and was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Equipment Performance attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, failure to demonstrate the torus coatings would perform satisfactorily in service resulted in a condition where the RHR and CS suction strainer debris loading could not be reasonably assured to remain sufficiently low to support an adequate water supply to RHR and CS, which are accident mitigating systems.

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors used IMC 0609, Appendix A, Exhibit 2 and determined this finding was of very low safety significance (Green) because the RA and DRA concluded there was not sufficient justification to challenge the licensee's operability conclusion.

Cross-Cutting Aspect: P.1 - Identification: The organization implements a corrective action program with a low threshold for identifying issues. Individuals identify issues completely, accurately, and in a timely manner in accordance with the program. The SIT determined that this finding had a cross-cutting aspect in the area Problem Identification and Resolution because individuals did not identify issues completely, accurately, and in a timely manner in

accordance with the Corrective Action Program. Specifically, when addressing CARD 17-22973 which documented the discovery of dynamic coating conditions and a large section of damaged coatings in 2017, the licensee did not identify the associated inspection procedures failed to contain acceptance criteria applicable for the inspection results and that the results of the test areas were not being evaluated for continued coating acceptance.
Enforcement: Violation: Title 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," requires, in part, that a test program be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. It also requires that test results be evaluated to assure that test requirements have been satisfied. The torus coating is a structure, system, or component subject to the requirements of 10 CFR Part 50, Appendix B. The licensee originally accepted the improperly cured torus coating via suitability review, "Evaluation of Protective Coating Blisters Suppression Pool Interior Protective Coating," dated October 12, 1989. This design document contained acceptance criteria of "stable" and "spontaneous rupture of blisters and/or protective coating delamination will not occur under normal […] conditions." In addition, the licensee established procedures 34.144.001, "18-Month Suppression Pool (Torus) Inspection," Revision 22, and QCP-10-U-FERMI, "Torus Coating Inspection and Repair," Revision 1, to monitor the performance of torus coatings earlier that year. Since then, the procedures have been revised and superseded on multiple occasions. The procedures in effect at the time of this SIT were 43.000.019, "Primary Containment Inspection," Revision 9, and QCP-10-1, "Underwater Coating Inspection," Revision 3. Contrary to the above, since October 12, 1989, the licensee failed to assure that testing, required to demonstrate that the improperly cured torus coating would perform satisfactorily in service, was identified and performed in accordance with written test procedures which incorporated the requirements and acceptance limits contained in applicable design documents. In addition, the licensee failed to evaluate the associated test results to assure that test requirements have been satisfied. Specifically, the licensee's testing program for torus coating contained in procedures 34.144.001, Revision 22, and QCP-10-U-FERMI, Revision 1, did not incorporate the acceptance criteria applicable to the improperly cured torus coating developed by the 1989 suitability review (e.g. stable and not brittle). Similarly, none of the licensee's procedure revisions implemented after the 1989 inspections to monitor the performance of torus coatings incorporated that acceptance criteria. In addition, while the licensee identified torus coating test areas and documented test results after RF01, these test results were not evaluated to demonstrate the acceptability of the improperly cured torus coating. Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On January 14, 2020, the inspectors presented the special inspection results to Mr. M. Kirschenheiter and other members of the licensee staff.

- On November 14, 2019, the inspectors presented the Interim Exit inspection results to Mr. P. Fessler and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
93812	Calculations	TSR-36108	Increases in ECCS Suction Strainer Debris Load	04/27/2009
	Corrective Action Documents	14-20968	Enhancement – Torus Coatings Program Identified by Benchmarking at the 2014 EPRI Coatings Conference	02/11/2014
		98-12493	NRC Bulletin 96-03 Potential Plugging of ECCS Strainers	03/17/1998
		CARD 03-19948	Loss of All Offsite Power due to System Grid Disturbance	08/15/2003
		CARD 12-28374	Blistered Protective Coating On The Torus Wetted Region	10/10/2012
		CARD 15-26472	FO 15-02: Total loss of TBCCW Following Heat Exchanger Swap	09/14/2015
		CARD 16-26585	2016 CDBI: Add Clarification to 43.000.019 Coating Acceptance Criteria	08/19/2016
		CARD 17-22973	Extensive Coating Defects Identified during Torus Underwater Inspection	04/02/2017
		CARD 19-24218	2019 DBAI: NRC Concern Blistered Torus Coating	06/03/2019
		CARD 19-24457	2019 DBAI: Typo in UFSAR Section 6.2.1.6 Reference	06/12/2019
		CARD 19-24605	2019 DBAI: Recommended Clarifications to Procedure 43.000.019 Primary Containment Inspection	06/18/2019
		CARD 19-25068	2019 DBAI: Review Previous Evaluations of Torus Coating Impact on ECCS Strainers Including Consideration of New Vendor Evaluations	07/03/2019
		DER 89-1093	Torus Coatings	09/28/1989
	Corrective Action Documents Resulting from Inspection	CARD 19-25212	2019 SIT: Review Cancellation of Procedure 20.000.29 for Possible Reinstatement	07/10/2019
		CARD 19-25292	2019 SIT: Vendor Recommendations not Dispositioned	07/12/2019
		CARD 19-25296	2019 SIT: Work Order Steps Inappropriately N/A'd	07/13/2019
		CARD 19-25301	2019 SIT: Additional Documentation Requested Regarding Changes to Torus Coating	07/13/2019
		CARD 19-25302	SIT 2019: Corrective Action Improvements	07/13/2019
		CARD 19-25305	2019 SIT: Review OE #313595, Torus Coating Delamination Found During RFO24 at Duane Arnold for Applicability	07/13/2019
		CARD 19-25306	2019 SIT: Review OE #301553, and 310263 Related to Duane Arnold Trous Interior Surface Recoating	07/13/2019
		CARD 19-25307	2019 SIT: Sludge Generation Rate Verification	07/14/2019

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		CARD 19-25339	2019 SIT: Evaluate Potential Methods and Acceptance Values of Physical Testing for In-Service Torus Coating	07/14/2019
		CARD 19-25342	2019 SIT: CLO & Process Improvements for Less than Adequate Evaluation of RF18 Torus Coating Inspection Results	07/15/2019
		CARD 19-25376	2019 SIT: Vendor Reports Provided to the NRC Require Revision	07/16/2019
		CARD 19-25532	2019 SIT: Torus Coating Degradation MR Evaluation Deficiencies	07/21/2019
		CARD 20-20194	2019 SIT: Failure of Corrective Action Program to Capture Coating Degradation	01/08/2020
	Drawings	6C721-2305	Containment Vessels Suppression Chamber Penetrations	R
	Engineering Evaluations	0021-0056-CALC-001	Potential Debris from Degraded Torus Coatings	07/03/2019
		0021-0056-LTR-001	Evaluation of Internal Coating Integrity	07/03/2019
		1900679.401	Fermi-2 2019 DBAI Degraded Torus Coatings Assessment on Emergency Core Cooling System (ECCS) Performance	07/02/2019
		B8-51	Torus Repair Coating Test Report	08/18/1989
		DECO-12-2191	Evaluation of Containment Coatings	4
		DET001.001	Evaluation of Protective Coating Blisters Suppression Pool Interior Protective Coating	10/12/1989
		NUC2016135.00	Evaluation of Fermi 2 Blister Torus Wetted (Immersion) Region Substrate Coatings	03/10/2017
	Miscellaneous		RF01 Coating Inspection Report - Interior Protective Coating, Suppression Chamber Underwater Desludging, Inspection and Repair	10/1989
			KTA Coating Inspection Records	11/08/1995
		NUC2007106	Torus Desludge, Inspection & Coating Repair	12/05/2007
		NUC2009103	Torus Desludge, Inspection & Coating Repair	06/30/2009
		FER - NUC0980108	Torus Coating Inspection and Repair	11/24/1998
		FER-7051	Torus Desludging, Inspection and Coating Repair	08/09/1991
		FER-7135	Underwater Desludging, Inspection and Coating Repair of	10/27/1994

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			the Torus Pressure Boundary	
		FER-NUC2004105	Torus Desludge, Coating Inspection and Repair	08/23/2004
		NUC2001106	Torus Desludge, Inspection & Coating Repair	05/13/2002
		NUC2012102	Torus Desludge, Inspection & Coating Repair	06/04/2012
		NUC2017123	Reactor Torus Desludge, ASME XI IWE VT Exams, Coatings Inspection & Coating Repair - Immersion Area	05/30/2017
		NUC2018130	Reactor Torus Desludge, ASME XI IWE VT Exams, Coatings Inspection & Coating Repair - Immersion Area	11/12/2018
		Purchase Order Number 4701230546	Purchase Order from DTE Energy to Underwater Engineering Services Inc.	11/15/2018
	Operability Evaluations	EFA-E11-16-004	Impact of Additional Containment Penetration Min-K on ECCS Suction Strainer Design	09/10/2016
		EFA-T23-19-006	Evaluation of Degraded Coatings in Torus	07/19/2019
	Procedures	20.000.29	LPCI and Core Spray Suppression Pool Suction Strainer Clogging	2
		23.425.01	Primary Containment Procedures	79
		3071-359	Design Specification for Field Painting Level I Steel and Concrete Coating Inside Drywell	C
		3071-360	Design Specification: Interior Protective Coating Suppression Chamber - Reactor Building	E
		3071-405	Vendor/OEM Application of Service Level I Coatings on Components to be Installed in the Drywell	A
		34.144.001	Underwater Coating Inspection	22
		34.144.001	18 Month Suppression Pool (torus) Inspection	21
		43.000.19	Primary Containment Inspection	1
		43.000.19	Primary Containment Inspection	2
		43.000.19	Primary Containment Inspection	3
		43.000.19	Primary Containment Inspection	4
		43.000.19	Primary Containment Inspection	5
		43.000.19	Primary Containment Inspection	6
		43.000.19	Primary Containment Inspection	7

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		43.000.19	Primary Containment Inspection	8
		43.000.19	Primary Containment Inspection	9
		MES25	Visual Examination	8
		MES46	ASME Section XI Containment Inservice Inspection Program	6
		QCP 10-1	Underwater Coating Inspection	2
		QCP 10-1	Underwater Coating Inspection	1
		QCP 10-1	Underwater Coating Inspection	0
		QCP-10-1	Underwater Coating Inspection	3
		QCP-10-1-Fermi-7135	Underwater Coating Inspection	3
		QCP-10-2	Underwater Coating Repair	3
		QCP-10-U-Fermi	Torus Coating Inspection and Repair	1
	Work Orders	25975596	Sludge Generation Rate Survey	05/21/2009
		37481505	Desludge, Inspect, Repair - Torus Coatings Below Water Level	03/16/2014
		38442118	Desludge, Inspect, Repair - Torus Coatings Below Water Level	04/18/2017
		48693770	Sludge Generation Rate survey	10/14/2018

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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July 3, 2019

MEMORANDUM TO: Néstor J. Féliz Adorno, Senior Reactor Inspector
Division of Reactor Safety, Region III

FROM: Mohammed Shuaibi, Acting Director
Division of Reactor Safety, Region III

SUBJECT: SPECIAL INSPECTION TEAM CHARTER FOR FERMI NUCLEAR POWER PLANT, UNIT 2, POTENTIAL TORUS STRAINER BLOCKAGE

On May 29, 2019, the U.S. Nuclear Regulatory Commission (NRC) Design Bases Assurance Inspection Team discovered information regarding the condition of torus coatings at Fermi, Unit 2, which called into question the licensee's ability to ensure adequate net positive suction head (NPSH) to multiple safety pumps (e.g., emergency core cooling and torus cooling systems) following a postulated design basis accident (DBA). The licensee's underwater coating inspections have found evidence the torus coatings have progressively degraded since approximately 2012. Specifically, the licensee has documented the discovery of new coating blisters, enlargement of existing blisters, coating delamination, and coating embrittlement. The Design Bases Assurance Inspection Team had concerns with whether the licensee had sufficiently evaluated these discoveries to ensure the torus coating would not block the torus suction strainers. Currently, the full extent of condition is unknown. The licensee is completing additional analyses to evaluate this condition.

Based on the deterministic criteria provided in Management Directive (MD) 8.3, "NRC Incident Investigation Program," the incident met MD 8.3 criterion (a) because the current strainer debris loading margin is small when compared to the total coating area in question. The incident also met MD 8.3 criterion (g) because a previous engineering inspection (i.e., the 2016 Component Design Basis Inspection) identified three non-cited violations related to the licensee's efforts to ensure the strainers functionality support the NPSH of safety systems during a DBA. Some of the issues described in the previous non-cited violations remain unresolved and may further challenge the current strainer debris loading margin. Lastly, the incident met MD 8.3 criterion (h) because of questions regarding the licensee's effectiveness at addressing torus suction strainer blockage issues and ensuring the strainers would remain functional to support the NPSH of safety systems during a DBA. The risk assessment resulted in an Incremental Conditional Core Damage Probability of approximately 1E-6 to 1E-5 assuming the most likely scenarios to result in strainer blockage are medium and large break loss of coolant accidents.

CONTACT: Karla Stoedter, DRS
630-829-9731

Accordingly, based on the deterministic criteria and risk criteria in MD 8.3, and as provided in Regional Procedure 8.31, “Special Inspections at Licensed Facility,” a Special Inspection Team will commence an inspection on July 10, 2019. The Special Inspection Team will be led by you and will include Michael Jones from the Region III office, and Matthew Yoder, Stephen Smith, and James Gavula from the Office of Nuclear Reactor Regulation.

The special inspection will evaluate the facts, circumstances, and the licensee’s actions surrounding the recent torus coating inspection results and the potential for torus suction strainer blockage issues. On a daily basis, the Team should evaluate the need for changing the scope of the inspection if conditions warrant.

The team’s charter is enclosed.

Docket No: 50-341
License No: NPF-43

Enclosure:
Fermi Special Inspection Team Charter

FERMI NUCLEAR POWER PLANT, UNIT 2, SPECIAL INSPECTION CHARTER

This Special Inspection Team is chartered to assess the licensee's analysis and current performance related to ensuring the torus strainers will remain functional to support the net positive suction head of safety systems during a postulated design basis accident (DBA). Emphasis should be placed on assessing the torus coating degradation identified by the 2019 Design Bases Assurance Inspection Team. The Special Inspection will be conducted in accordance with Inspection Procedure 93812, "Special Inspection," and will include, but not be limited to, the items listed below. This charter may be revised based on the results and findings of the inspection. The results will be documented in NRC Inspection Report 05000341/2019050.

1. Establish a sequence of events related to the installation, monitoring, evaluation, and repair of torus coatings since the construction of Fermi Nuclear Power Plant, Unit 2. This would include dates and, when relevant, times for the installation and acceptance of the initial torus coating and recoating, subsequent coating inspections, disposition of coating inspection issues including repairs, and any occurrence having the potential to challenge the suction strainer debris loading. This would also include dates for submittals to the NRC involving torus coatings as it relates to suction strainer performance or license renewal.

2. Review the licensee's evaluations of the potential degraded torus coating impact to the functionality of safety systems. This would include the licensee's acceptance of the degraded torus coating areas identified during coating inspections and the licensee's recent evaluations performed in response to the associated 2019 Design Bases Assurance Inspection Team questions. This review would also consider the aggregate effects of other unresolved challenges to the suction strainers such as the issues identified by the 2016 Component Design Basis Inspection Team, which were documented in Inspection Report 05000341/2016007.

3. Review the licensee's maintenance of the torus coating condition. This may include procedures and practices used during coating monitoring, evaluation, and repair. This may also include a review of vendor and/or manufacturer literature.

4. Review the effectiveness of the licensee's Corrective Action Program at addressing internal and recent (since 2010) external operating experience involving torus coatings and suction strainer blockage issues.

5. Continually evaluate the complexity and significance of the circumstances to determine whether they warrant escalation of the inspection to an augmented inspection team.

Charter Approval

/RA/ 07/03/19 — K. Stoedter, Chief, Engineering Branch 2, DRS

/RA/ 07/03/19 — J. Lara, Director, Division of Reactor Projects

/RA/ 07/03/19 — M. Shuaibi, Director, Division of Reactor Safety

Enclosure