20.0 REQUIREMENTS RESULTING FROM FUKUSHIMA NEAR-TERM TASK FORCE RECOMMENDATIONS

This chapter addresses the Fukushima Near-Term Task Force (NTTF) recommendations that are applicable to the Fermi 3 Combined License (COL). The applicable recommendations address four topics: a reevaluation of the seismic hazard (related to Recommendation 2.1), mitigation strategies for beyond-design-basis external events (related to Recommendation 4.2), spent fuel pool (SFP) instrumentation (related to Recommendation 7.1), and emergency preparedness (EP) staffing and communications (related to Recommendation 9.3).

Background

In response to the events at Fukushima resulting from the March 11, 2011, Great Tohoku earthquake and tsunami in Japan, the U.S. Nuclear Regulatory Commission (NRC) established the NTTF to conduct a systematic and methodical review of NRC processes and regulations (1) to determine whether the agency should make additional improvements to its regulatory system; and (2) to make recommendations to the Commission for policy directions. In July 2011, the NTTF issued a 90-day report, SECY-11-0093 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML11186A950), "Near Term Report and Recommendations for Agency Actions Following the Events in Japan," identifying 12 recommendations. On September 9, 2011, in SECY-11-0124, "Recommended Actions to Be Taken without Delay from the NTTF Report," (ADAMS Accession No. ML11245A144) the staff submitted to the Commission for its consideration NTTF recommendations that can and—in the staff's judgment—should be partially or entirely initiated without delay. In SECY-11-0124, the staff identified and concluded that specific actions to address a subset of the NTTF recommendations would provide the greatest potential for improving safety in the near term:

1. Recommendation 2.1: Seismic and Flood Hazard Reevaluations

2. Recommendation 2.3: Seismic and Flood Walkdowns

3. Recommendation 4.1: Station Blackout Regulatory Actions

4. Recommendation 4.2: Equipment Covered under Title 10 of the *Code of Federal Regulations* (10 CFR) 50.54(hh)(2)

5. Recommendation 5.1: Reliable Hardened Vents for Mark I Containments

6. Recommendation 8: Strengthening and Integration of Emergency Operating Procedures, Severe Accidents Management Guidelines, and Extensive Damage Mitigation Guidelines

7. Recommendation 9.3: Emergency Preparedness Regulatory Actions (staffing and communications).

On October 3, 2011, in SECY-11-0137, "Prioritization of Recommended Actions to Be Taken in Response to Fukushima Lessons Learned," (ADAMS Accession No. ML11272A203), the staff identified two actions in addition to the actions discussed in SECY-11-0124 that had the greatest potential for improving safety in the near term. The additional actions are as follows:

- Inclusion of Mark II containments in the staff's recommendation for reliable hardened vents associated with NTTF Recommendation 5.1.

- The implementation of SFP instrumentation proposed in Recommendation 7.1.

The staff also proposed to the Commission three tiers of prioritization for the NTTF recommendations. The first tier consists of those NTTF recommendations which the staff determined should be started without unnecessary delay and for which sufficient resource flexibility, including availability of critical skill sets, exists. The second tier consists of those NTTF recommendations which could not be initiated in the near term due to factors that include the need for further technical assessment and alignment, dependence on Tier 1 issues, or availability of critical skill sets. These actions do not require long-term study and can be initiated when sufficient technical information and applicable resources become available. The third tier consists of those NTTF recommendations that require further staff study to support a regulatory action, have an associated shorter-term action that needs to be completed to inform the longer-term action, are dependent on the availability of critical skill sets, or are dependent on the resolution of NTTF Recommendation 1.

On February 17, 2012, in SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" (ADAMS Accession No. ML12039A103), the staff provided the Commission with proposed orders and requests for information to be issued to all power reactor licensees and holders of construction permits.

On March 9, 2012, the Commission approved issuing the proposed orders with some modifications in the staff requirements memorandum (SRM) to SECY-12-0025. As set forth in SRM-SECY-12-0025, the proposed orders are needed for continued adequate protection or to provide a substantial increase in the protection of public health and safety. In accordance with its statutory authority under Section 161 of the Atomic Energy Act of 1954, as amended (the Act), the Commission may impose these requirements.

On March 12, 2012, the NRC issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events"; and Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," to the appropriate licensees and permit holders, including the only holder at that time of a COL issued under 10 CFR Part 52, Southern Nuclear Operating Company, the licensee and operator of the Vogtle Electric Generating Plant Units 3 and 4 (ADAMS Accession Nos. ML12054A679 and ML12054A735). The staff also issued the requests for information pursuant to 10 CFR 50.54(f) regarding Recommendations 2.1, 2.3, and 9.3 to the appropriate licensees and construction permit holders in letters dated March 12, 2012 (ADAMS Accession No. ML12053A340).

The following Tier 1 recommendations from SECY-11-0137 as modified in SECY-12-0025 were considered in determining those that are applicable to the Fermi 3 COL review:

1. Recommendation 2.1: Seismic and Flood Hazard Reevaluations

2. Recommendation 2.3: Seismic and Flood Walkdowns

3. Recommendation 4.1: Station Blackout Regulatory Actions

4. Recommendation 4.2: Equipment Covered under 10 CFR 50.54(hh)(2)

5. Recommendation 5.1: Reliable Hardened Vents for Mark I and Mark II Containments

6. Recommendation 7.1: Spent Fuel Pool Instrumentation

7. Recommendation 8: Strengthening and Integration of Emergency Operating Procedures, Severe Accidents Management Guidelines, and Extensive Damage Mitigation Guidelines

8. Recommendation 9.3: Emergency Preparedness Regulatory Actions (staffing and communications)

The staff determined that the following four recommendations are applicable and should be addressed by the Fermi 3 COL applicant:

1. Recommendation 2.1: Seismic reevaluations - Order licensees to reevaluate the seismic hazards at their sites against current NRC requirements and guidance and, if necessary, update the design basis and structures, systems, and components (SSCs) important to safety to protect against the updated hazards.

2. Recommendation 4.2: Equipment covered under 10 CFR 50.54(hh)(2) - Order licensees to provide reasonable protection for equipment currently provided pursuant to 10 CFR 50.54(hh)(2) from the effects of design-basis external events, and to add equipment as needed to address multiunit events while other requirements are being revised and implemented.

3. Recommendation 7.1: Spent fuel pool instrumentation - Order licensees to provide sufficient safety-related instrumentation, able to withstand design-basis natural phenomena, and to monitor SFP parameters (i.e., water level, temperature, and area radiation levels) from the control room.

4. Recommendation 9.3: Emergency preparedness regulatory actions (staffing and communications) - Order licensees to do the following until rulemaking is complete:

    - Determine and implement the required staff to fill all necessary positions for responding to a multi-unit event.

    - Provide a means to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones and satellite telephones) during a prolonged station blackout.

The staff determined that the remaining Tier 1 recommendations did not need to be considered further in the Fermi 3 COL review. The applicant evaluated the flood hazard using current guidance and methodologies. The staff thus determined that the applicant has already addressed the flood hazard reevaluation portion of Recommendation 2.1. Therefore, there

are no additional requirements left to address in Recommendation 2.1 for flooding reevaluations applicable to the Fermi 3 COL application. Additionally, the staff determined that Recommendation 2.3 was not applicable to the Fermi 3 COL because the plant is not yet constructed. The staff also determined that Recommendation 5.1 is not applicable because it applies to boiling-water reactor plant designs with Mark I and Mark II containments.

Recommendations 4.1 and 8 did not need to be considered further because SECY-11-0137 and the associated SRM direct that regulatory actions associated with these recommendations should be initiated through rulemaking.

In SECY-12-0025, the staff stated that all COL applicants would be asked to provide the information addressed in the orders and the requests for information through the review process. Accordingly, for the Fermi 3 COL application, the staff issued several requests for additional information (RAIs) related to the implementation of Fukushima NTTF recommendations pertaining to seismic hazard reevaluations; mitigation strategies for beyond-design-basis external events; SFP instrumentation; and EP staffing and communications based on Recommendations 2.1, 4.2, 7.1, and 9.3, as modified by SRM-SECY-12-0025. The following sections of this chapter present the staff's safety evaluation related to these areas.

20.1 Recommendation 2.1, Seismic Hazard Reevaluation

20.1.1 Introduction

SECY-12-0025, Enclosure 7, Attachment 1 to Seismic Enclosure 1 (ADAMS Accession No. ML12039A188) related to seismic hazard reevaluations specifies the use of NUREG–2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," in a site probabilistic seismic hazard analysis (PSHA) and describes an updated cumulative absolute velocity (CAV) filter methodology. The staff issued NUREG–2115 in January 2012 as a replacement for the Electric Power Research Institute-Seismic Owners Group (EPRI-SOG) (EPRI 1986, 1989) and the Lawrence Livermore National Laboratory (LLNL) (Bernreuter et al., 1989) seismic source models for the central and eastern United States (CEUS). NUREG–2115 describes the implementation of a Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 assessment process for developing the new regional seismic source characterization model for the CEUS (CEUS-SSC). Consistent with SECY-12-0025, as well as the need to consider the latest available information in the PSHA for the site, the staff requested the applicant to evaluate the seismic hazards at the Fermi 3 site against current NRC requirements and guidance.

20.1.2 Summary of Application

The applicant provided information to evaluate the seismic hazard at its site against current NRC requirements and guidance. Safety Evaluation Report (SER) Section 2.5.2, "Vibratory Ground Motion," and SER Section 3.7.1, "Seismic Design," provide detailed summaries of the Fermi 3 application related to the seismic hazard evaluation and calculation of the uniform hazard response spectra (UHRS); ground motion response spectra (GMRS); foundation input response spectra (FIRS); and performance-based surface response spectra (PBSRS). This section briefly summarizes the information.

On January 31, 2012, the NRC, U.S. Department of Energy (DOE), and EPRI issued a new seismic source characterization model and report for use in seismic hazard assessments for nuclear facilities in the CEUS. This cooperative project replaces seismic source models

developed in the 1980s by the EPRI-SOG (EPRI 1986, 1989) and the LLNL (Bernreuter et al., 1989). The applicant used the CEUS-SSC model for the seismic hazard reevaluation in the response to RAI 01.05-1 (ADAMS Accession No. ML12137A770). SER Section 2.5.2 describes this model in detail. RAI 01.05-1 requested the applicant to evaluate the seismic hazard at its site against current NRC requirements and guidance—as described in SECY-12-0025, Enclosure 7, Attachment 1 to Seismic Enclosure 1 (ADAMS Accession No. ML012039A188)—and to modify the site-specific GMRS and FIRS if changes are necessary given the evaluation. The applicant responded to RAI 01.05-1 in a letter dated January 25, 2013 (ADAMS Accession No. ML13032A378), which includes the following items:

1. Results of demonstration calculations showing the adequate implementation of the CEUS-SSC model using the Fermi 3 project PSHA software.

2. Seismic hazard results for reference CEUS hard rock conditions using the CEUS-SSC model.

3. Updated site amplification functions for a revised GMRS location based on the deaggregation of the seismic hazard derived using the CEUS-SSC model.

4. Seismic hazard results at the GMRS elevation calculated using the CEUS-SSC model with a fixed lower bound magnitude of M5 instead of the CAV filter.

5. An updated GMRS based on the CEUS-SSC model.

The applicant subsequently incorporated Items 2 through 5 into Fermi 3 COL FSAR, Section 2.5.2 in a letter dated March 15, 2013 (ADAMS Accession No. ML13079A490). In addition, the applicant submitted the updated FIRS and PBSRS as proposed revisions to Fermi 3 COL FSAR, Section 3.7.1 in a letter dated April 26, 2013 (ADAMS Accession No. ML13150A223).

20.1.3 Regulatory Basis

The applicable regulatory requirements for the seismic hazard reevaluation are established and described in Subsections 2.5.2.3 and 3.7.1.3 of this SER. The applicable regulatory requirements are as follows:

- 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion (GDC) 2, “Design basis for protection against natural phenomena.”

- 10 CFR Part 50, Appendix S, “Earthquake Engineering Criteria for Nuclear Power Plants.”

- Processes for changes and departures in 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”

- 10 CFR 52.79(a)(1)(iii), as it relates to considerations of the most severe natural phenomena historically reported for the site and the surrounding area.

- 10 CFR 100.23, “Geologic and Seismic Siting Criteria.”

In addition, the seismic hazards reevaluation should be consistent with the following applicable guidance:

- NUREG–0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition),” the Standard Review Plan (SRP).

- Regulatory Guide (RG) 1.60, Revision 1, "Design Response Spectra for Seismic Design of Nuclear Power Plants.”

- RG 1.132, Revision 2, "Site Investigations for Foundations of Nuclear Power Plants.”

- RG 1.206; “Combined License Applications for Nuclear Power Plants (LWR Edition).”

- RG 1.208; “A Performance-Based Approach to Define Site-Specific Earthquake Ground Motion.”

- Design Certification/COL-Interim Staff Guidance (DC/COL-ISG)-017, “Ensuring Hazard-Consistent Seismic Input for Site Response and Soil Structure Interaction Analyses.”

20.1.4 Technical Evaluation

SER Section 2.5.2 provides the staff’s evaluation of the applicant’s Fermi 3 site seismic hazard calculation using the CEUS-SSC model, which was performed in accordance with SECY-12-0025 and the updated UHRS and GMRS. SER Section 3.7.1 provides the staff’s evaluation of the updated FIRS and PBSRS. For the staff’s conclusions with respect to the adequacy of these analyses, see Sections 2.5.2 and 3.7.1 of this SER.

To address the guidance in SECY-12-0025, Enclosure 7, Attachment 1 to Seismic Enclosure 1, the applicant evaluated potential seismic hazards at the Fermi 3 site using the CEUS-SSC model (NUREG–2115) and applying the fixed lower bound magnitude of M5 as described in the SECY. Because the Fermi 3 rock hazard based on the CEUS-SSC model is generally higher than that obtained from the updated EPRI-SOG model in Revision 4 of the Fermi 3 FSAR, the applicant performed an update of the Fermi 3 site PSHA and GMRS based on the CEUS-SSC model. The applicant thus revised Fermi 3 FSAR Section 2.5.2 and submitted the proposed revisions in a letter dated March 15, 2013 (ADAMS Accession No. ML13079A490). The applicant also revised FSAR Section 3.7.1 and submitted the proposed revisions in a letter dated April 26, 2013 (ADAMS Accession No. ML13150A223). Based on the staff’s technical evaluation in SER Subsections 2.5.2.4 and 3.7.1.4, and the conclusions documented in those SER subsections, the staff concludes that the applicant has accurately calculated the Fermi site-specific UHRS, GMRS, FIRS, and PBSRS using the CEUS-SSC model recommended in SECY-12-0025, Enclosure 7, Attachment 1 to Seismic Enclosure 1. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.1-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, Confirmatory Item 20.1-1 is closed.

20.1.5 Post Combined License Activities

There are no post COL activities related to this section.

20.1.6 Conclusion

NRC staff reviewed the information submitted by the applicant in response to SECY-12-0025 regarding Recommendation 2.1, the seismic hazard reevaluation. The staff confirms that the applicant has adequately addressed the necessary information and has evaluated the seismic hazards at the Fermi 3 site against the current NRC requirements and guidance in 10 CFR 100.23; 10 CFR 52.79 (a)(1)(iii); 10 CFR Part 50, Appendix A, GDC 2; 10 CFR Part 50, Appendix S; NUREG–0800, Sections 2.5.2, and 3.7.1; RG 1.60; RG 1.132; RG 1.206; RG 1.208; and DC/COL-ISG-017.

20.2 Recommendation 4.2, Mitigation Strategies for Beyond-Design-Basis External Events

20.2.1 Introduction

SECY-12-0025 states that the staff will request all COL applicants to provide the information addressed in the orders (EA-12-049, EA-12-050, and EA-12-051) through the review process. For mitigation strategies for beyond-design-basis external events, SECY-12-0025 outlines a three-phase approach. The initial phase involves the use of installed equipment and resources to maintain or restore core cooling, containment, and spent fuel pool cooling (SFPC) without alternating current power. The transition phase involves providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase involves obtaining sufficient offsite resources to sustain those functions indefinitely.

The Japan Lesson-Learned Project Directorate (JLD)-ISG-2012-01, Revision 0, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” (ADAMS Accession No. ML12229A174) endorses with clarification the methodologies described in the industry guidance document Nuclear Energy Institute (NEI) 12–06, Revision 0, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” (ADAMS Accession No. ML12242A378) and provides an acceptable approach for satisfying the applicable requirements.

Application of JLD-ISG-2012-01 to new reactors, such as Fermi 3, requires appropriate consideration of the approaches to nuclear safety inherent in the specific designs. The Fermi 3 nuclear power plant references the Economic Simplified Boiling-Water Reactor (ESBWR) standard design that utilizes passive design features that provide core cooling, containment, and SFPC capabilities for 72 hours without relying on alternating current (ac) power. The ESBWR design also includes additional installed ancillary equipment that could extend the time period from 72 hours to 7 days to maintain safety functions using available onsite resources.

20.2.2 Summary of Application

The applicant addresses mitigation strategies in Section 1.5.1.1.1, “Recommendation 4.2, Mitigating Strategies for Beyond-Design-Basis External Events” of the application. The NRC issued RAI Letter Number 78 (RAI 01.05-3 and RAI 01.05-4) dated July 3, 2012 (ADAMS Accession No. ML121850099); and RAI Letter Number 84 (RAI 01.05-5 and RAI 01.05-6) dated March 19, 2013 (ADAMS Accession No. ML13078A436). The NRC requested the applicant to address the three-phase approach for mitigating beyond-design-basis external events and the mitigating strategies for ensuring that core cooling, containment, and SFPC

capabilities function indefinitely. In letters responding to RAI Letter 84 dated April 18, 2013 (ADAMS Accession No. ML13109A426); July 9, 2013 (ADAMS Accession No. ML13192A301); and February 28, 2014 (ADAMS Accession No. ML14064A284), the applicant described the three-phase mitigation strategies for beyond-design-basis external events. The applicant responded to RAI Letter Number 78 in a letter dated August 24, 2012 (ADAMS Accession No. ML12240A184); and in subsequent supplemental response letters dated January 25, 2013 (ADAMS Accession No. ML13028A402); and February 19, 2013 (ADAMS Accession No. ML13051A657). In the response to the RAIs, the applicant proposed adding the following license condition related to mitigation strategies for beyond-design-basis external events:

> At least 180 days before the date scheduled for initial fuel load as set forth in the notification submitted in accordance with 10 CFR § 52.103(a), DTE Electric Company shall use the guidance contained in JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0 and the information presented in Fermi FSAR Section 01.05 to complete the development of strategies and guidance for maintaining and, if necessary restoring core cooling, containment, and SFPC capabilities beginning 72 hours after loss of all normal and emergency ac power sources, including any alternate ac source under 10 CFR 50.63. These strategies must be capable of:
>
> - Mitigating a simultaneous loss of all ac power sources, both from the onsite and offsite power systems, and loss of normal access to normal heat sink,
>
> - Maintaining core cooling, containment, and SFPC capabilities for Fermi Unit 3 during and after such an event affecting both Fermi Unit 2 and 3, and
>
> - Being implemented in all plant modes.
>
> Before initial fuel load, DTE Electric Company shall fully implement the strategies and guidance required in this license condition, including procedures, training, and acquisition, staging or installation of equipment and consumables relied upon in the strategies.

The RAI response also included a proposed revision to the COL application Part 10, Section 3.8.2, "Mitigation Strategies for Beyond-Design-Basis External Events."

20.2.3 Regulatory Basis

The requirements and guidance for mitigation strategies for beyond-design-basis external events are established or described in the following:

- Atomic Energy Act of 1954, as amended (the Act), Section 161, authorizes the Commission to regulate the possession and utilization of special nuclear material in a manner that is protective of public health and in accordance with the common defense and security.

- 10 CFR 52.97(a)(1) which authorizes the Commission to issue a COL if it finds, among other things, that issuance of the license will not be inimical to the health and safety of the public. This regulation applies here because the Commission found in

Order EA-12-049 that it is necessary for power reactor licensees to develop, implement and maintain guidance and strategies to restore or maintain core cooling, containment, and SFP cooling capabilities in the event of a beyond-design-basis external event in order to ensure adequate protection of the public health and safety.

- SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 – Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated March 9, 2012, approves the issuance of orders for beyond-design-basis external events, as necessary, for ensuring the continued adequate protection under the 10 CFR 50.109(a)(4)(ii) exception to the Backfit Rule.

- Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012. Although Order EA-12-049 does not apply to Fermi 3, the staff has followed the current NRC and industry guidance for mitigation strategies in evaluating the equipment used as part of the FLEX mitigation strategy for Fermi 3.

- JLD-ISG-2012-01, Revision 0, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," issued August 29, 2012, endorses NEI 12–06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (issued August 21, 2012), with exceptions/clarifications.

20.2.4 Technical Evaluation

The NRC issued Order EA-12-049 on March 12, 2012, which required operating reactor licensees and construction permit holders to deploy strategies that will enhance their ability to cope with conditions resulting from beyond-design-basis external events. Attachment 2 to Order EA-12-049 specifies the use of a three-phase approach for mitigating these events. The initial phase involves the use of installed equipment and resources to maintain or restore core cooling, containment and SFPC capabilities. The transition phase involves providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from offsite. The final phase involves obtaining sufficient offsite resources to sustain those functions indefinitely. Application of the three-phase approach to new reactors, such as Fermi 3, requires appropriate consideration of the approaches to nuclear safety inherent in the specific designs.

In RAI 01.05-5, the staff requested the applicant to address how the initial and transition phase mitigation will be accomplished in the event of an extended loss of ac power (ELAP) event at Fermi 3. RAI 01.05-3 requested the applicant to address the final phase mitigation describing the strategies for maintaining and restoring core cooling, containment and SFPC capabilities with use of offsite resources. The staff also requested the applicant to address the ability to implement the strategies in all modes.

Initial and Transition Phase Mitigation – Core Cooling and Containment Function

In the response to RAI 01.05-5 dated April 18, 2013 (ADAMS Accession No. ML13109A426), the applicant provided information on the mitigating strategies that would be used to cope with an ELAP resulting from a beyond-design-basis external event. For this evaluation, the applicant assumed that the plant would be in a station blackout (SBO), which assumes a loss

of all offsite power sources with a concurrent loss of the onsite standby diesel generators. The applicant's response indicated that, for the ESBWR, the underlying strategies for coping with an extended loss of ac power events involve a three-phase approach; and that the passive safety features of the ESBWR and the installed ancillary equipment provide a significant coping period.

In regard to the initial phase mitigation, the applicant's response to RAI 1.05-5 states the following:

> Section 15.5.5 and Section 19A.2.2 of the ESBWR Design Control Document (DCD), which are incorporated by reference into the Fermi 3 FSAR, provide a performance evaluation for station blackout and show conformance to the requirements of 10 CFR 50.63 as it relates to maintaining core cooling, inventory control, and containment heat removal.
>
> The analysis in DCD Tier 2, Section 15.5.5 demonstrates that reactor water level is maintained above the top of the active fuel by operation of the ICS [isolation condenser system], a safety-related system. Because the ICS removes the reactor decay heat to the IC/PCCS [passive containment cooling system] pools that are outside the containment, the containment and suppression pool pressures and temperatures are maintained within the design limits. Therefore the integrity of the containment is maintained. As described in DCD, Section 15.2.2.9, during refueling mode, GDCS [gravity-driven cooling system] is available to ensure extended core cooling and inventory control for at least 72 hours.

The applicant indicated that the design basis for the ESBWR standard plant includes passive features that provide core, containment, and SFPC capabilities for 72 hours, with no reliance on ac power. Section 19A.2.2 of the ESBWR DCD states that "the ESBWR is designed such that no operator actions or AC power are required for a station blackout event, for 72 hours," and the ESBWR is designed to successfully mitigate an SBO event to meet the requirements of 10 CFR 50.63, "Loss of all alternating current," using safety-related SSCs. This 72-hour mitigation capability addresses the initial phase mitigation for ESBWR plants such as Fermi 3, and this mitigation capability provides adequate time to transition to final phase mitigation, without necessarily relying upon a transition phase. This is because the transition phase is defined as the time necessary for resources to be brought from offsite and 72 hours is a sufficiently long time period. Nevertheless, the ESBWR design includes installed ancillary equipment that could potentially extend the time period for transition from the initial phase mitigation to final phase mitigation to 7 days.

10 CFR 50.63(a)(2) includes a provision that is the premise for the acceptance of an SBO for core cooling and the containment function. The provision requires the following:

> The reactor core and associated coolant, control, and protection systems, including station batteries and any other necessary support systems, must provide sufficient capacity and capability to ensure that the core is cooled and appropriate containment integrity is maintained in the event of an SBO for the specified duration. The capability for coping with an SBO of specified duration shall be determined by an appropriate coping analysis.

ESBWR DCD, Tier 2, Section 15.5.5 contains the results of the DCD applicant's performance evaluation for an SBO showing conformance to the requirements of 10 CFR 50.63.

NRC staff reviewed ESBWR DCD, Tier 2, Section 15.5.5, as part of the ESBWR DCD review. In Subsection 15.5.5.4 of the ESBWR Final Safety Evaluation Report SER (FSER) in NUREG–1966, "Final Safety Evaluation Report Related to the Certification of the Economic Simplified Boiling-Water Reactor," the staff concluded that

> The ESBWR reactor core and associated coolant, control, and protection systems, including station batteries and other necessary support systems, provide sufficient capacity and capability to ensure that the core is cooled and appropriate containment integrity in the event of an SBO for 72 hours. The applicant conducted an appropriate coping analysis to demonstrate the capability for coping with an SBO with a 72-hour duration, and hence, the acceptance criteria are satisfied.

Fulfilling the requirements for an SBO, per 10 CFR 50.63, but without reliance on an alternate ac source, assures adequate core and containment cooling of the plant for operating modes ranging from normal power operation (Mode 1) to safe shutdown (Mode 4). Adequate cooling must also be provided when the plant is in cold shutdown (Mode 5) and refueling (Mode 6).

In Mode 5, when insufficient steam is available to drive the ICS, the GDCS can be used to perform the core cooling function. In Mode 6, the only core cooling systems available during the ELAP event are the GDCS and the suppression pool. In ESBWR FSER Section 16.2.8, the staff's discussion of RAI 16.2-37 states that General Electric-Hitachi performed an analysis to show that the water above the core will be sufficient to keep the core covered and to maintain an adequate level of shielding. Based on the results of this analysis, the staff concludes that in Mode 6 with the reactor cavity flooded up, a sufficient water inventory would exist for 72 hours to passively provide decay heat removal and to protect the fuel. DCD Tier 2, Subsection 19A.3.1.1 states that during shutdown conditions, either the GDCS or the flooded-up refueling volume is sufficient to ensure core cooling. Once activated, neither power nor controls are necessary to maintain these functions for 72 hours. The staff therefore concludes that the strategies adequately address that for an ELAP in Modes 5 and 6, core cooling, has been adequately addressed because sufficient water either from the GDCS pools and the suppression pool or from the flooded-up refueling volume will be available, and is sufficient to ensure core cooling for 72-hours.

For the transition phase, NRC order EA-12-049 allows use of portable, onsite equipment and consumables to maintain or restore core cooling, containment, and SFPC functions until they can be accomplished with resources brought from offsite (e.g., on Page 4 of the order). As discussed above, the initial phase mitigation of 72 hours provides sufficient time for resources to be brought from offsite. As such, reliance on a transition phase is not necessary for Fermi 3.

In the response to RAI 01.05-5 the applicant also discusses a coping strategy to extend the cooling capability beyond 72 hours and for up to 7 days. In particular, the applicant states that following the 72-hour passive system coping time, support is required to continue passive system cooling and makeup to the IC/PCCS pools and spent fuel storage pools. This support could be provided by installed plant ancillary equipment as discussed in ESBWR DCD Tier 2, Section 19A.3.1, "Actions Required Beyond 72 Hours." Section 19A.3.1 describes the post 72-hour actions and the use of installed regulatory treatment of non-safety systems (RTNSS) equipment for core, containment, and spent fuel cooling safety functions. NRC's evaluation of

the ESBWR RTNSS program is provided in Chapter 22, "Regulatory Treatment of Nonsafety Systems," of the ESBWR FSER, and includes an evaluation of the augmented design standards for RTNSS equipment to withstand external events such as earthquakes, hurricanes, tornadoes, and floods.

Initial and Transition Phase Mitigation – Spent Fuel Pool Cooling

The applicant addressed mitigation strategies for SFPC in the response to the first question in RAI 01.05-5. That response addressed the initial phase mitigation with the following statement:

> As described in the ESBWR DCD, Section 9.1.3.2, which is incorporated by reference into the Fermi 3 FSAR, during a loss of spent fuel pool and buffer pool cooling, cooling of the spent fuel pool and buffer pool is accomplished by allowing the water in the pools to heat and boil. There is sufficient water in each pool to ensure adequate fuel cooling for 72 hours.

The applicant addressed the transition phase mitigation by stating the following:

> DCD Section 19A.3.1, which is incorporated by reference into the Fermi 3 FSAR, describes the post 72-hr actions and credits use of installed regulatory treatment of non-safety systems (RTNSS) equipment.
>
> After 72 hours, nonsafety-related systems are used to replenish the passive systems to perform these safety functions directly. As described in Section 9.1.3, and 19A.3.1, after 72 hours, makeup water can be provided through installed safety-related connection to the Fire Protection System (FPS) or spent fuel storage pool. Between 72 hours and seven days, the resources for performing theses safety functions are available onsite.

The staff reviewed the information regarding the ESBWR SFPC as part of the review of the ESBWR DCD, which is documented in Section 9.1.3 of the ESBWR DCD FSER. The staff concludes that for both the buffer pool and the SFP, the water levels and free volumes are sufficient to ensure that for 72 hours following a loss of forced cooling without active cooling water makeup, the water levels in the pools will remain above the top of active fuel (TAF) which provides sufficient time for initial phase mitigation and for resources to be bought from offsite.

Similar to that for the core cooling and containment functions discussed above, installed plant ancillary equipment could potentially extend this time period to 7 days.

Final Phase Mitigation

To support core cooling, containment, and spent fuel pool cooling post 72-hours, the ESBWR design has installed ancillary equipment with sufficient capacity. This equipment is designed to augmented design standards for external events, such as earthquakes, hurricanes, tornadoes, and floods, as documented in the ESBWR DCD Section 19A.3.1 and the NRC's ESBWR FSER Section 22.5.6. The ancillary equipment is capable of delivering at least minimum water quantities, at the minimum makeup rates, needed to support heat removal from the core and spent fuel pool. In its response to RAI 01.05-5 the applicant describes the

use of this equipment to allow the extension of the initial mitigation phase from 72 hours up to 7 days.

In its response to RAI 01.05-5, the applicant indicated that the ESBWR has safety-related connections through which makeup water can be supplied. These connections allow portable equipment brought in from offsite to be used to support continued operation of the ESBWR passive systems, as an alternative to the plant installed ancillary equipment if it is not available or operable. These connections would be used during the final mitigation phase.

In the response to RAI 01.05-3 dated February 28, 2014 (ADAMS Accession No. ML14064A2847), the applicant addresses final phase mitigation by proposing a license condition related to mitigation strategies for beyond-design-basis external events. Confirmation that the proposed license condition is included in the next revision of the COL application, Part 10, Section 3.8.2, was being tracked as **Confirmatory Item 20.2-1**. The staff reviewed the applicant's proposed license condition and revised it to enhance consistency with current staff expectations related to these mitigation strategies as stated below in Section 20.2.5 of this SER. Therefore, Confirmatory Item 20.2-1 is closed.

20.2.5 Post Combined License Activities

The ESBWR design incorporated by reference into the Fermi COL includes passive design features that provide core cooling, containment, and SFPC for 72 hours without reliance on ac power. These features do not rely on access to any external water sources. The ESBWR design also includes onsite equipment to replenish water sources and charge batteries. Connections are provided for using generators and pumping equipment that can be brought from offsite.

For the reasons discussed in 20.2.4, Technical Evaluation, the staff will include the following license condition related to the mitigating strategies program:

> **License Condition (20.2-1)**: Mitigation Strategies for Beyond-Design-Basis External Events
>
> a. DTE Electric Company shall complete development of an overall integrated plan of strategies to mitigate a beyond-design-basis external event at least 1 year before the completion of the last ITAAC on the schedule required by 10 CFR 52.99(a).
>
> b. The overall integrated plan required by this condition must include guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities. The overall integrated plan must include provisions to ensure that all accident mitigation procedures and guidelines (including the guidance and strategies required by this section, emergency operating procedures, abnormal operating procedures, and extensive damage management guidelines) are coherent and comprehensive.
>
> c. The guidance and strategies required by this condition must be capable of (i) mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the normal heat sink and (ii) providing for adequate capacity to perform the functions upon which the guidance and

strategies rely for all units on the Fermi site and in all modes at each unit on the site.

d. Before initial fuel load, DTE Electric Company shall fully implement the guidance and strategies required by this condition, including:

   1. Procedures;

   2. Training;

   3. Acquisition, staging, or installation of equipment and consumables relied upon in the strategies; and

   4. Configuration controls and provisions for maintenance and testing (including testing procedures and frequencies for preventative maintenance) of the equipment upon which the strategies and guidance required by this condition rely.

e. The training required by condition d.2 must use a Systematic Approach to Training (SAT) to evaluate training for station personnel, and must be based upon plant equipment and procedures upon which the guidance and strategies required by this section rely.

f. DTE Electric Company shall maintain the guidance and strategies described in the application upon issuance of the license, and the integrated plan of strategies upon its completion as required by condition a. DTE may change the strategies and guidelines required by this Condition provided that DTE evaluates each such change to ensure that the provisions of conditions b and c continue to be satisfied and DTE documents the evaluation in an auditable form.

20.2.6 Conclusion

The staff reviewed the applicant's proposed mitigating strategies discussed in Section 1.5.1.1.1 of the application for ensuring that core cooling, containment, and SFPC capabilities function indefinitely without ac power, in the event of a beyond-design-basis external event resulting in an extended loss of ac power. The staff also evaluated the applicant's mitigating strategies for the Fermi 3 ESBWR in the responses to RAI 01.05-3 and RAI 01.05-5. The staff finds that the approach for mitigating beyond-design-basis external events to be used at Fermi 3 is consistent with NRC Order EA-12-049. The staff also finds that the ESBWR passive design features provide for initial phase mitigation because core cooling, containment function and SFPC are achieved without ac power or operator action for the first 72 hours. In addition, through the implementation of the final phase mitigation using offsite FLEX equipment, core cooling, containment function and SFPC can be extended indefinitely.

20.3 Recommendation 7.1, Reliable Spent Fuel Pool Instrumentation

20.3.1 Introduction

During the events in Fukushima, responders were without reliable instrumentation to determine the water level in the SFP. This raised concerns that the pool may have boiled dry, resulting in fuel damage, which highlighted the need for reliable SFP instrumentation. The current SFP water level instrumentation at U.S. nuclear power plants is typically a narrow range and, therefore, it is only capable of monitoring normal and slightly off-normal conditions. Although the likelihood of a catastrophic event affecting nuclear power plants and the associated SFPs in the United States remains very low, beyond-design-basis external events could challenge the ability of existing SFP instrumentation to provide emergency responders with reliable information on the condition of the SFPs. Reliable and available indicators are essential to ensure that plant personnel can effectively prioritize emergency actions.

SECY-12-0025 (ADAMS Accession No. ML12039A103) states that for DC and COL applications submitted under 10 CFR Part 52 and in active staff review, the staff plans to assure that the Commission-approved Fukushima actions are addressed before certification or licensing. The staff will request all COL applicants to provide the information addressed in the orders (EA-12-049, EA-12-050, and EA-12-051) and the request for information letters described in this SECY paper, as applicable, through the review process.

JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," (ADAMS Accession No. ML12221A339) endorses with exceptions and clarifications the methodologies described in the industry guidance document NEI 12–02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," (ADAMS Accession No. ML122400399) and provides an acceptable approach for satisfying the applicable requirements.

20.3.2 Summary of Application

The applicant addresses reliable spent fuel pool instrumentation in Section 1.5.1.1.2, "Recommendation 7.1, Reliable Spent Fuel Pool Instrumentation" of the application. The NRC issued RAI Letter Number 78 (RAI 01.05-4) dated July 3, 2012 (ADAMS Accession No. ML121850099), and RAI Letter 84 (RAI 01.05-6) dated March 19, 2013 (ADAMS Accession No. ML13078A436). In these RAI letters, the staff requested the applicant to address the provisions for monitoring key SFP parameters as described in Order EA-12-051 dated March 12, 2012 (ADAMS Accession No. ML12054A679), which are not part of the ESBWR DCD, and to include any proposals for changes to the current application. The applicant responded to these RAIs in letters dated August 24, 2012 (ADAMS Accession No. ML12240A184); January 25, February 19, April 18, July 9 and October 15, 2013 (ADAMS Accession Nos. ML13028A402, ML13051A057, ML13109A426, ML13192A301, and ML13311A101 respectively). As part of the RAI responses, the applicant described the SFP and the buffer pool level instrument design features that ensure a reliable indication of the water level in the SFP and buffer pools. The applicant proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2, "Recommendation 7.1, Reliable Spent Fuel Pool Instrumentation"; and a license condition in Part 10, Revision 4, Section 3.8.3, "Reliable Spent Fuel Pool/Buffer Pool Level Instrumentation," which verifies that the programmatic aspects of the order are completed and implemented prior to initial fuel loading.

20.3.3 Regulatory Basis

The requirements and guidance for reliable SFP instrumentation are established or described in the following:

- Atomic Energy Act of 1954, as amended, (the Act), Section 161, authorizes the Commission to regulate the possession and utilization of special nuclear material in a manner that is protective of public health and in accordance with common defense and security.

- 10 CFR 52.97(a)(1) which authorizes the Commission to issue a COL if it finds, among other things, that issuance of the license will not be inimical to the health and safety of the public. This regulation applies here because the Commission found in Order EA-12-049 that it is necessary for power reactor licensees to develop, implement and maintain guidance and strategies to restore or maintain core cooling, containment, and SFP cooling capabilities in the event of a beyond-design-basis external event in order to ensure adequate protection of the public health and safety.

- SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 – Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated March 9, 2012, approves the issuance of orders for reliable SFP instrumentation under an administrative exemption to the Backfit Rule.

- Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012.

- JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," issued August 29, 2012, endorses NEI 12–02, Revision 1, "Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," with exceptions and clarifications.

20.3.4 Technical Evaluation

As a result of SECY-12-0025, the staff issued RAI Letter 78 (RAI 01.05-4) requesting additional information in relation to the lessons learned from the Great Tohoku Earthquake and Tsunami. In RAI 01.05-4, the staff requested the applicant to address the provisions for monitoring key SFP parameters as described in the order dated March 12, 2012, which are not part of the ESBWR design—including any proposals for changes to the current application.

In Commission Order EA-12-051, the NRC describes the key parameters used to determine that a level instrument is considered reliable. NEI 12–02, Revision 1 provides an acceptable approach for satisfying the applicable requirements. The staff evaluated the applicant's response to RAI 01.05-4 and determined that additional information was needed. The staff issued RAI 01.05-6 requesting the applicant to provide further clarification on the level instrument design criteria and programmatic aspects. In the applicant's responses, they suggested the creation of a new license condition in Section 3.8.3 to Part 10 of the COL application; and FSAR changes to Tier 2, Subsection 1.5.1.1.2 that provided further design information and discussed how the SFP level instrument is designed to be reliable according to the guidance in NEI 12–02. The applicant's response and the proposed FSAR changes

take credit for design information already described in several sections of the ESBWR DCD. The staff's evaluation of the DCD sections is discussed in the ESBWR DCD FSER (NUREG-1966) and is not part of this SER.

Instruments

In Commission Order EA-12-051, Attachment 2, Section 1.1 states that the SFP level instrument channels shall consist of a permanent and fixed primary instrument channel and a backup instrument channel. The backup instrument channel may be fixed or portable. Portable instruments shall have capabilities that enhance the ability of trained personnel to monitor the SFP water level under conditions which restrict direct personnel access to the pool, such as partial structural damage, high radiation levels, or heat and humidity from a boiling pool.

The applicant's response to RAI 01.05-6 (ADAMS Accession No. ML13192A301) proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2, which references ESBWR DCD, Tier 2, Section 9.1.3 which states that the SFP and the buffer pool each have two wide-range, safety-related level transmitters that transmit signals to the main control room. These signals are used to indicate a collapsed water level and to initiate high/low-level alarms, both locally and in the main control room. ESBWR DCD, Tier 2, Subsection 7.5.5.3.1 indicates that the safety-related pool monitoring instrumentation design conforms to Institute for Electrical and Electronics Engineers (IEEE) Standard (Std) IEEE Std 603–1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations."

The staff noted that the ESBWR DCD credits the SFP pool level instruments as operational in environmental conditions consistent with boiling down to the top of the active fuel. These conditions would result in a high temperature (100 degrees Celsius [212 degrees Fahrenheit]), high humidity, steaming environment, loss of shielding, and high radiation doses. The staff evaluated the instrument description in the RAI response and the proposed changes to the FSAR. The staff determined that crediting two permanently installed, safety-related, seismic Category I instruments is in accordance with the design features identified in Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Arrangement

In Commission Order EA-12-051, Attachment 2, Section 1.2 states that the SFP level instrument channels shall be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP. This protection may be provided by locating the safety-related instruments to maintain instrument channel separation within the SFP area, and to utilize inherent shielding from missiles provided by existing recesses and corners in the SFP structure.

The applicant's response to RAI 01.05-6 states that the SFP level instrument channels will be arranged in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP. The applicant's response refers to ESBWR DCD, Tier 2, Subsection 7.5.5.3.2, which indicates that the SFP and the buffer pool instrumentation meets the separation criteria set forth in 10 CFR Part 50,

Appendix A, GDC 24, "Separation of protection and control system." Also, ESBWR DCD, Tier 2, Section 7.5.5 indicates that the safety-related pool monitoring instrumentation is designed to satisfy the requirements of IEEE Standard 603–1991, as endorsed by RG 1.153, Revision 1, "Criteria for Safety Systems," which includes requirements for the physical separation of channels to avoid a common mode failure due to a missile. ESBWR DCD, Tier 2, Subsection 3.8.4.1.1 indicates that the reactor building, which houses the buffer pool, is a seismic Category I structure. ESBWR DCD, Tier 2, Subsection 3.8.4.1.3 describes the fuel building, which houses the SFP facilities and their supporting system and heat, ventilation, and air conditioning (HVAC) equipment, as a seismic Category I structure except for the penthouse that houses HVAC equipment. The penthouse is a seismic Category II structure. ESBWR DCD, Tier, 2 Section 3.5 describes the missile assessment for the ESBWR. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 reference the ESBWR DCD sections mentioned above.

The staff evaluated the ESBWR DCD and confirmed that the DCD provides design features to protect safety-related components against missiles. The staff evaluated the instrument location description in the applicant's RAI response and the proposed changes to the FSAR. The staff determined that crediting the channel separation is an acceptable approach that provides reasonable protection against missiles. Therefore, the staff concludes that these features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of **Confirmatory Item 20.3-1**. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Mounting

In Commission Order EA-12-051, Attachment 2, Section 1.3 states that the installed instrument channel equipment within the SFP shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the SFP structure.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Subsection 7.5.5.3.3 indicates that the SFP and the buffer pool instrumentation are seismically qualified and this includes the equipment mounting configuration. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 reference the ESBWR DCD section mentioned above.

The staff evaluated the RAI response and the proposed FSAR changes. The staff determined that designing the instrument and its mounting to be seismically qualified will ensure that both will retain their design functionality following a seismic event. The staff concludes that these features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Qualification

In Commission Order EA-12-051, Attachment 2, Section 1.4 states that primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturation conditions for an extended period.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Section 9.1.3 indicates that both the SFP and the buffer pool each have two wide-range, safety-related level transmitters. ESBWR DCD, Tier 2, Subsection 7.5.5.3.3 indicates that the pool instrumentation is subject to environmental qualification and post-accident monitoring criteria. ESBWR DCD, Tier 2, Subsections 7.5.5.3.1 and 7.5.5.3.2 indicate that the pool instrumentation system conforms to quality standards for safety-related equipment. The ESBWR DCD credits the SFP pool level instruments as operational in environmental conditions consistent with boiling down to the top of the active fuel. These conditions would result in a high temperature (100 degrees Celsius [212 degrees Fahrenheit]), high humidity, steaming environment, loss of shielding, and high radiation doses. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 reference the ESBWR DCD sections mentioned above.

The staff reviewed the applicant's response and the proposed FSAR changes. The staff determined that the instrumentation will be designed to quality standards for safety-related equipment and to remain operational while exposed to the environmental conditions following an accident event. The staff finds that these features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Independence

In Commission Order EA-12-051, Attachment 2, Section 1.5 states that the primary instrument channel shall be independent of the backup instrument channel.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Subsection 7.5.5.3.2 states that the instrument channels are physically and electronically independent, in accordance with GDC 24.

The staff reviewed the applicant's response and concludes that this feature is in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved.

Power Sources

In Commission Order EA-12-051, Attachment 2, Section 1.6 states that the permanently installed instrumentation channels shall each be powered by a separate power supply. Permanently installed and portable instrumentation channels shall provide for power connections from sources independent of the plant ac and direct current (dc) power distribution systems, such as portable generators or replaceable batteries.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Subsection 7.5.5.3.2 states that the instrument channels are physically and electronically independent, in accordance with GDC 24. The safety-related primary and backup instrumentation channels are controlled by the safety-related distributed control and

information system (Q-DCIS). ESBWR DCD, Tier 2, Section 7.1.2 describes the divisional Q-DCIS components as powered by redundant, independent, and separated uninterruptible power supplies (UPSs) dedicated to their division with a battery backup (per division) for at least 72 hours. After 72 hours, the Q-DCIS can operate continuously on power from the ancillary diesel generators until offsite power is restored.

Commission Order EA-12-051 specifies that all permanently installed instrumentation channels are to be provided with power connections from sources independent of the plant ac and dc power distribution systems. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 state that the instrument channels will be provided with an alternate connection to sources independent of the plant ac and dc power distribution systems, such as portable generators or replaceable batteries, thus allowing for quick and accessible connections of sources. The alternate power source and replaceable batteries used for instrument channel power will have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.

The staff reviewed the applicant's response and the proposed changes to FSAR Subsection 1.5.1.1.2. The staff noted that the level instrument channels are powered by separated safety-related sources capable of powering the instruments for up to 72 hours. After 72 hours, the instrument channel can be powered by the ancillary diesel generators. In the event that these power sources are not available, the applicant's proposed changes to FSAR Subsection 1.5.1.1.2 state that these instrument channels will have the capability of being quickly connected to an alternate power source independent from the plant ac and dc power distribution systems. The staff evaluated the applicant's RAI response and the proposed FSAR changes. The staff concludes that these design features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Accuracy

In Commission Order EA-12-051, Attachment 2, Section 1.7 states that the instrument shall maintain its designed accuracy following a power interruption or a change in the power source without recalibration.

The applicant's response to RAI 01.05-6 and the proposed changes to FSAR Subsection 1.5.1.1.2 state that the instrument channels will be capable of maintaining the original accuracy following a power interruption or a change in power source without recalibration. The revised FSAR subsection also references ESBWR DCD, Tier 1, Table 2.6.2-2, which verifies that the instruments meet the minimum instrument accuracy of ±300 millimeters (mm) (±1 ft).

The staff reviewed the applicant's system description and the proposed FSAR changes. The staff concludes that these design features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Testing

In Commission Order EA-12-05, Attachment 2, Section 1.8 states that the instrument channel design shall provide for routine testing and calibration.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Subsection 9.1.3.4 indicates that the fuel and auxiliary pools cooling system (FAPCS) is designed to permit surveillance testing and in-service inspection of the safety-related components and the components required to perform the post-accident recovery functions in accordance with GDC 45, "Inspection of cooling water system," and American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC) Section XI. In addition, Fermi 3 COL Application Part 4, "Technical Specifications," Section 3.7.5, includes periodic surveillance of the fuel pools water level during the movement of irradiated fuel assemblies in the associated fuel storage pool or when irradiated fuel assemblies are stored in the associated fuel storage pool. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 reference the ESBWR DCD and the technical specifications sections mentioned above.

The staff reviewed the applicant's system description, the ESBWR design, and the proposed FSAR changes. The staff concludes that these design features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Display

In Commission Order EA-12-051, Attachment 2, Section 1.9 states that trained personnel shall be able to monitor the SFP water level from the control room, the alternate shutdown panel, or other appropriate and accessible locations. The display shall provide on-demand or continuous indication of the SFP water level.

The applicant's response to RAI 01.05-6 noted that ESBWR DCD, Tier 2, Section 9.1.3 states that both the SFP and the buffer pool each have two wide-range, safety-related, level transmitters that transmit signals to the main control room. These signals are used for on demand or continuous collapsed water level indications and to initiate high/low-level alarms, both locally and in the main control room. The proposed changes to FSAR Tier 2, Subsection 1.5.1.1.2 reference the ESBWR DCD section mentioned above.

The staff reviewed the applicant's system description and the proposed FSAR changes. The staff concludes that these design features are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the proposed FSAR changes are in the next FSAR revision was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

Programs

In Commission Order EA-12-051, Attachment 2, Section 2 states that the SFP instrumentation shall be maintained to be available and reliable through the appropriate development and

implementation of a training program. Personnel shall be trained in the use and maintenance (including test and calibration), and in the procedures for providing alternate power to the level instrument channels.

The applicant's response to RAI 01.05-6 stated that FSAR Section 13.2 includes a description of the training programs for operators and emergency response actions. FSAR Section 13.5 describes the development of procedures under the Plant Operating Procedures Development Plan that will address the procedures, testing, and calibration requirements of the installed instrument channels as identified in the Commission's order. In addition, the applicant has proposed new license condition in Section 3.8.3 to Part 10 of the COL application requiring that prior to fuel loading, the SFP and the buffer pool instrumentation shall be maintained to be available and reliable through the appropriate development and implementation of a training program. Personnel shall be trained in the use and the provision of alternate power to the safety-related level instrument channels.

The staff evaluated the applicant's RAI response and the proposed license condition. The staff finds that the program descriptions provided are in conformance with Commission Order EA-12-051 and the guidance in JLD-ISG-2012-03. Therefore, this part of RAI 01.05-6 is resolved. Confirmation that the license condition changes are in the next revision of the COL application, Part 10, Section 3.8.3, was being tracked as part of Confirmatory Item 20.3-1. The staff confirmed that these changes have been incorporated into the Fermi 3 COL FSAR. Therefore, this part of Confirmatory Item 20.3-1 is closed.

20.3.5 Post Combined License Activities

For the reasons discussed in the "Technical Evaluation" section above, the staff proposes to include the following license condition related to the SFP instrumentation.

> **License Condition (20.3-1)**: Reliable Spent Fuel Pool/Buffer Pool Level Instrumentation
>
> Prior to initial fuel load, DTE Electric Company shall address the following requirements using the guidance contained in JLD-ISG-2012-03, "Compliance with Order EA-2012-051, Reliable Spent Fuel Pool Instrumentation," Revision 0:
>
> The spent fuel pool/buffer pool instrumentation shall be maintained available and reliable through the development and implementation of a training program. The training program shall include provisions to ensure trained personnel can route the temporary power lines from the alternate power source to the appropriate connection points, and connect the alternate power source to the safety-related level instrument channels.

20.3.6 Conclusion

The staff evaluated the applicant's RAI responses, the current FSAR, the proposed license condition, and the proposed FSAR changes related to the SFP water level instrumentation. The staff concludes that these instruments are designed in accordance with the guidance in JLD-ISG-2012-03. Therefore, these instruments are considered reliable, able to withstand beyond-design-basis natural phenomena, and able to monitor key SFP level parameters as described in Commission Order EA-12-051.

20.4 Recommendation 9.3, Emergency Preparedness

20.4.1 Introduction

The accident at Fukushima reinforced the need for effective EP. The objective of EP is to ensure that the capability exists for a licensee (or COL applicant) to implement measures that mitigate the consequences of a radiological emergency and to provide for protective actions of the public. The accident at Fukushima highlighted the need to determine the staff needed to respond to a multi-unit event. Additionally, there is a need to ensure that the communication equipment relied on has adequate power to coordinate the response to an event during an ELAP.

20.4.2 Summary of Application

In the response to RAI 01.05-2 dated April 18, 2013 (ADAMS Accession No. ML13109A426), the applicant proposed the following license condition related to EP communications and staffing to address Fukushima NTTF Recommendation 9.3:

> Communications:
>
> At least two (2) years prior to scheduled initial fuel load, the licensee [Detroit Edison] shall have performed an assessment of on-site and offsite communications systems and equipment required during an emergency event to ensure communications capabilities can be maintained during prolonged station blackout conditions. The communications capability assessment will be performed in accordance with NEI 12–01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0.
>
> At least one hundred eighty (180) days prior to scheduled initial fuel load, the licensee [Detroit Edison] shall complete implementation of corrective actions identified in the communications capability assessment described above, including any related emergency plan and implementing procedure changes and associated training.
>
> Staffing:
>
> At least two (2) years prior to scheduled initial fuel load, the licensee [Detroit Edison] shall have performed assessments of the on-site and augmented staffing capability to satisfy the regulatory requirements for response to a multi-unit event. The staffing assessments will be performed in accordance with NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities", Revision 0.
>
> At least two (2) years prior to scheduled initial fuel load, the licensee [Detroit Edison] shall revise the Fermi 3 Emergency Plan to include the following:
>
> - Incorporation of corrective actions identified in the staffing assessments described above.

- Identification of how the augmented staff will be notified given degraded communications capabilities.

20.4.3 Regulatory Basis

The requirements for EP for beyond-design-basis external events are established or described in the following:

- 10 CFR 50.47(b)(6) states that provisions exist for prompt communications among principal response organizations to emergency personnel and to the public.

- 10 CFR 50.47(b)(1) states, in part, "and each principal response organization has staff to respond and to augment its initial response on a continuous basis."

- 10 CFR 50.47(b)(2) states, in part, "adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, timely augmentation of response capabilities is available …"

- 10 CFR Part 50, Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," Section IV. E.9 states that adequate provisions shall be made and described for emergency facilities and equipment including "at least one onsite and one offsite communications system; each system shall have a backup power source."

The guidance for EP for beyond-design-basis external events is established or described in the following:

- SECY-12-0025 states, in part, that the staff will also request all COL applicants to provide information required by the orders and request for information letters described in this paper, as applicable, through the review process.

- NEI 12–01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities", Revision 0 - By NRC letter from David Skeen, Director, Japan Lessons-Learned Directorate, to NEI, Susan Perkins-Grew, Director, Emergency Preparedness, dated May 15, 2012, NRC finds the guidance in NEI 12-01 to be an acceptable method for licensees to employ when responding to the 10 CFR 50.54(f) letters regarding NTTF Recommendation 9.3 (ADAMS Accession No. ML12131A043).

- NUREG–0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Section B, "Onsite Emergency Organization," states (in part),

  > 5. Each licensee shall specify... functional areas of emergency activity...These assignments shall cover the emergency functions in Table B-1 entitled, "Minimum Staffing Requirements for Nuclear Power Plant Emergencies." The minimum on-shift staffing shall be as indicated in Table B-1. The licensee must be able to augment on-shift capabilities within a short period after declaration of an emergency. This capability shall be as indicated in Table B-1...

- NUREG–0696, “Functional Criteria for Emergency Response Facilities,” offers guidance on how to meet the requirements of Appendix E to 10 CFR Part 50 and describes the onsite and offsite communications requirements for the licensee’s emergency response facilities.

20.4.4 Technical Evaluation

In RAI Letter 77 dated May 17, 2012 (ADAMS Accession No. ML12137A770); and RAI Letter 79 dated August 7, 2012 (ADAMS Accession No. ML12216A305), the NRC issued RAI 01.05-2 and RAI 13.03-65, respectively, requesting the applicant to provide information concerning the implementation of Fukushima NTTF Recommendation 9.3. In the responses to RAI 01.5-2 dated April 18, 2013 (ADAMS Accession No. ML13109A426), and RAI 13.03-65 dated April 30, 2013 (ADAMS Accession No. ML13123A076), the applicant proposed a license condition to address the requested information in each RAI and to meet the information requests of the 10 CFR 50.54(f) letters sent to existing licensees—including COL applicants—regarding communications and staffing for NTTF Recommendation 9.3. The proposed license condition is listed in Section 20.4.2 of this SER. As part of the license condition, the applicant is committed to perform communication and staffing assessments using the guidance in NEI 12–01, Revision 0 (ADAMS Accession No. ML12125A412). In a letter from the NRC to NEI dated May 15, 2012 (ADAMS Accession No. ML1213A043), the NRC stated that the guidance in NEI 12–01, Revision 0 provides an acceptable method for licensees to employ when responding to the 10 CFR 50.54(f) letters regarding NTTF Recommendation 9.3. The applicant proposed the license condition on communications and staffing in Section 3.8.1 to Part 10 of the COL application. However, the NRC staff has revised the timeframe of the completion of this license condition to be consistent with the schedules provided in 10 CFR 52.99 (a) and 10 CFR 52.103(a). Confirmation that the proposed license condition related to EP is in the next revision of the COL application, Part 10, was being tracked as **Confirmatory Item 20.4-1**. The staff reviewed the applicant’s proposed license condition and revised it to reflect the NRC’s expectation when addressing NTTF Recommendation 9.3 as stated below in Section 20.4.5 of this SER. Therefore, Confirmatory Item 20.4-1 is closed.

20.4.5 Post Combined License Activities

For the reasons discussed in the “Technical Evaluation” section above, the staff proposes to include the following license conditions related to communications and staffing for emergency planning actions:

> **License Condition (20.4-1)**: Emergency Planning Actions
>
> Prior to initial fuel load, DTE Electric Company will fully implement the following requirements for emergency planning actions related to communications and staffing.
>
> Communications:
>
> At least 18-months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, DTE Electric Company shall have performed an assessment of on-site and off-site communications systems and equipment required during an emergency event to ensure communications capabilities can be maintained during prolonged station blackout conditions. The communications capability assessment will be

performed in accordance with NEI 12–01, “Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities”, Revision 0.

At least one hundred eighty (180) days before the date scheduled for initial fuel load as set forth in the notification submitted in accordance with 10 CFR 52.103(a), DTE Electric Company shall complete implementation of corrective actions identified in the communications capability assessment described above, including any related emergency plan and implementing procedure changes and associated training.

Staffing:

At least 18-months before the latest date set forth in the schedule submitted in accordance with 10 CFR § 52.99(a)for completing the inspections, tests, and analyses in the ITAAC, DTE Electric Company shall have performed assessments of the on-site and augmented staffing capability to satisfy the regulatory requirements for response to a multi-unit event. The staffing assessments will be performed in accordance with NEI 12–01, “Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities”, Revision 0.

At least 180 days before the date scheduled for initial fuel load set forth in the notification submitted in accordance with 10 CFR § 52.103(a), DTE Electric Company shall revise the Fermi 3 Emergency Plan to include the following:

- Incorporation of corrective actions identified in the staffing assessments described above.

- Identification of how the augmented staff will be notified given degraded communications capabilities.

20.4.6 Conclusion

The staff reviewed the applicant’s proposed license condition on communications and staffing in Section 3.8.1 to Part 10 of the COL application. The staff concludes that the license condition, as revised by the staff, is acceptable because it conforms to the guidance in SECY-12-0025 and NEI 12–01 regarding communications and staffing to address NTTF Recommendation 9.3; in NUREG–0654/FEMA-REP-1; and in NUREG–0696; and meets the applicable requirements of 10 CFR 50.47(b) and Appendix E.