3.9 Mechanical Systems and Components

3.9.1 Introduction

Section 3.9 of the Fermi 3 Combined License (COL) Final Safety Analysis Report (FSAR) addresses the structural integrity and functional capability of mechanical structures, systems, and components (SSCs), and incorporates by reference Section 3.9 of the Economic Simplified-Water Reactor (ESBWR) Design Control Document (DCD), Revision 10. Following the issuance of the ESBWR Final Safety Evaluation Report (FSER) on March 9, 2011, the Nuclear Regulatory Commission (NRC) staff identified issues applicable to the ESBWR steam dryer structural analysis based on information obtained during the NRC review of a license amendment request for a power uprate at an operating boiling-water reactor nuclear power plant. As a result of resolving those issues, General Electric–Hitachi (GEH) revised the DCD to withdraw the licensing topical reports (LTRs) addressing the ESBWR steam dryer structural evaluation, and to reference new engineering reports that describe the updated ESBWR steam dryer analysis methodology. The staff reviewed the revised DCD sections, the new GEH engineering reports, and the RAI responses. The Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) for the ESBWR DCD Tier 2, Section 3.9.5 replaces in its entirety Section 3.9.5, "Reactor Pressure Vessel Internals," of the DCD FSER issued on March 9, 2011. Information related to ESBWR reactor pressure vessel (RPV) internals other than the steam dryer (such as core support structures) was copied from the FSER and placed in the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) to provide the description of the staff's review of all ESBWR RPV internals in one location.

3.9.2 Summary of Application

Section 3.9 of the Fermi 3 COL FSAR, Revision 6, incorporates by reference Section 3.9 of the ESBWR DCD, Revision 10. In addition, in Fermi 3 COL FSAR, the applicant provides the following:

COL Items

- EF3 COL 3.9.9-1-A — Reactor Internals Vibration Analysis, Measurement and Inspection Program

To address COL Item 3.9.9-1-A, the Fermi 3 COL applicant provides the following supplemental information in FSAR Subsection 3.9.2.4:

> For reactor internals other than the steam dryer, the vibration assessment program, as specified in Regulatory Guide (RG) 1.20, is provided in DCD Appendix 3L and the following referenced GEH Report:
>
> - NEDE-33259P-A, "Reactor Internals Flow Induced Vibration Program"
>
> The classification of the Fermi 3 reactor internals in accordance with RG 1.20 is dependent on ESBWR status, i.e., if Fermi 3 is the initial ESBWR to perform testing of the reactor internals, or if testing is performed at another reactor prior to Fermi 3 testing. There are two different scenarios:

1. A valid prototype for the Fermi 3 reactor internals does not exist. Under this scenario, Fermi 3 reactor internals classification is a prototype per RG 1.20.

2. A valid prototype for Fermi 3 reactor internals does exist. If the prototype testing is performed outside the United States, the guidance in RG 1.20, Revision 3, Regulatory Position 1.2, would need to be satisfied in order for this reactor to be considered a "valid prototype." Assuming that Fermi 3 reactor internals are substantially similar to the valid prototype and that the valid prototype does not experience inservice problems that result in component or operational modifications, Fermi 3 reactor internals will be classified as non-prototype Category I. If a change to classification for Fermi 3 reactor internals is later determined to be necessary, the classification change will be addressed at the time the change is proposed with proper evaluation/justification and documented in a revision to the FSAR.

Specific to the steam dryer, the comprehensive vibration assessment program, as specified in RG 1.20, is provided in DCD Appendix 3L and the following referenced GEH reports:

- NEDE-33312P, "ESBWR Steam Dryer Acoustic Load Definition"
- NEDE-33313P, "ESBWR Steam Dryer Structural Evaluation"
- NEDE-33408P, "ESBWR Steam Dryer- Plant Based Load Evaluation Methodology, PBLE01 Model Description"

Unlike the overall classification for the reactor internals described above, the steam dryer is definitively classified as a prototype according to RG 1.20, Revision 3. Section 10.2 of NEDE-33313P provides four elements of a steam dryer Comprehensive Vibration Assessment Program that must be addressed. The following describes the approach for the steam dryer Comprehensive Vibration Assessment Program elements, consistent with RG 1.20 and Section 10.2 of NEDE-33313P:

1. The ESBWR steam dryer Comprehensive Vibration Assessment Program is described in DCD Section 3.9, DCD Appendix 3L, and NEDE-33313P, Section 10.0, which includes a description for preparing and submitting to the NRC a Steam Dryer Monitoring Plan no later than 90 days before startup.

2. The detailed design of the steam dryer will follow the methodology described in DCD Appendix 3L and the incorporated engineering reports. As described in NEDE-33313P, Section 10.2(b), an example of a steam dryer predicted analysis that concludes the steam dryer will not exceed stress limits with applicable bias and uncertainties and the minimum alternating stress ratio of 2.0 is provided in NEDE-33408P. The final detailed design of the ESBWR steam dryer has not yet been completed. Therefore, the example of an as-designed steam dryer that has been subject to the predicted analysis process and successful startup testing

described in NEDE-33408P serves as the design analysis report for the steam dryer and provides sufficient information for licensing. The post licensing commitments in ITAAC and license conditions confirm the acceptability of the ESBWR steam dryer design.

3. The startup program and associated license conditions that include appropriate notification points during power ascension, providing data to the NRC at certain hold points and at full power, and providing to the NRC a full stress analysis report and evaluation within 90 days of reaching the full power level, are established in accordance with NEDE-33313P, Section 10.2(c).

4. Periodic steam dryer inspection during refueling outages is as described in NEDE-33313P, Section 10.2(d), and associated license conditions.

In addition, in FSAR Subsection 3.9.2.4, the applicant identifies two commitments—COM 3.9-001 and COM 3.9-006—related to the development of a comprehensive vibration assessment and the associated reports. These commitments are listed later in this section.

- STD COL 3.9.9-2-A ASME Class 2 or 3 or Quality Group D Components with 60-Year Design Life

To address COL 3.9.9-2-A, the Fermi 3 COL applicant adds the following two commitments in FSAR Subsection 3.9.3.1:

<u>Commitment (COM 3.9-002)</u>:

The equipment stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1.

<u>Commitment (COM 3.9-004):</u>

The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.

- STD COL 3.9.9-3-A Inservice Testing Programs

To address COL Item 3.9.9-3-A, the Fermi 3 COL applicant specifies FSAR provisions to supplement ESBWR DCD Tier 2, Section 3.9.6, "Inservice Testing of Pumps and Valves." For example, the Fermi 3 FSAR specifies that in addition to the provisions in ESBWR DCD Tier 2, Section 3.9.6, milestones for implementing the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) preservice and inservice testing programs are defined in FSAR Section 13.4. In addition to the provisions in ESBWR DCD Tier 2, Subsection 3.9.6.1, "Inservice Testing of Valves," the Fermi 3 FSAR specifies that valves are subject to preservice testing. In addition to the provisions in ESBWR DCD Tier 2, Subsection 3.9.6.1.4, "Valve Testing," the Fermi 3 FSAR provides additional provisions for valve exercise tests. The Fermi 3 FSAR also specifies additional provisions for the design and qualification process for explosively actuated valves. In addition to the power-operated valve test provisions in ESBWR DCD Tier 2, Subsection 3.9.6.1.5, "Specific Valve Test Requirements," the Fermi 3 FSAR refers to Subsection 3.9.6.8 for additional (non-Code) testing of power-operated valves as discussed in Regulatory Issue Summary (RIS) 2000-03, "Resolution of Generic Safety Issue 158:

Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions." In addition to the check valve exercise test provisions in ESBWR DCD Tier 2, Subsection 3.9.6.1.5, the Fermi 3 FSAR specifies that check valve testing includes verification that obturator movement is in the direction required for the valve to perform its safety function. The Fermi 3 FSAR also includes additional check valve test provisions for (1) acceptance criteria, (2) a disassembly examination program where test methods are impractical, (3) nonintrusive diagnostic techniques, (4) post-maintenance testing, (5) preoperational testing, and (6) data collection for testing and inspections. In addition to the provisions in ESBWR DCD Tier 2, Subsection 3.9.6.5, "Valve Replacement, Repair and Maintenance," the Fermi 3 FSAR provides additional provisions for determining new reference values. In addition to the provisions in ESBWR DCD Tier 2, Subsection 3.9.6.8, "Non-Code Testing of Power-Operated Valves," the Fermi 3 FSAR provides additional provisions for performing periodic tests of power-operated valves that are consistent with the guidance in NRC RIS 2000-03.

- STD COL 3.9.9-4-A A Snubber Inspection and Test Program

To address COL Item 3.9.9-4-A, the Fermi 3 COL applicant specifies FSAR provisions that will supplement ESBWR DCD Tier 2, Subsection 3.9.3.7.1(3)e, "Snubber Preservice and Inservice Examination and Testing." For example, the Fermi 3 FSAR provides additional provisions to supplement the provisions for preservice examination and testing, and inservice examination and testing, of snubbers in ESBWR DCD Tier 2, Subsection 3.9.3.7.1(3)e. In addition, the Fermi 3 FSAR provides additional provisions for listing snubber information to supplement ESBWR DCD Tier 2, Subsection 3.9.3.7.1(3)f, "Snubber Support Data."

In addition, in FSAR Subsection 3.9.3.7.1(3)f, the applicant identifies two commitments (COM 3.9-003 and COM 3.9-005) for preparing a piping and components plant-specific table that will include snubber information and the scheduled update of the FSAR to include snubber information. These commitments are listed later in this section.

Supplemental Information

- STD SUP 3.9-1 10 CFR 50.55a Relief Requests and Code Cases

The Fermi 3 FSAR supplements ESBWR DCD Tier 2, Subsection 3.9.6.6, "10 CFR 50.55a Relief Requests and Code Cases," by specifying that no relief from or alternative to the ASME OM Code is being requested.

- STD SUP 3.9-2 Risk-Informed Inservice Testing

The Fermi 3 FSAR supplements ESBWR DCD Tier 2, Section 3.9.7, "Risk-Informed Inservice Testing," by specifying that risk informed inservice testing is not being utilized.

- STD SUP 3.9-3 Risk-Informed Inservice Inspection of Piping

The Fermi 3 FSAR supplements ESBWR DCD Tier 2, Section 3.9.8, "Risk-Informed Inservice Inspection of Piping," by stating that "risk informed inservice inspection is not being utilized."

Commitments

Fermi 3 FSAR Section 3.9 includes the following commitments for specific components:

Commitment (COM 3.9-001):

Fermi 3 FSAR Section 3.9.2.4: For reactor internals other than the steam dryer, the comprehensive vibration assessment program will be developed and implemented as described in DCD Appendix 3L with no departures. The vibration measurement and inspection programs will comply with the guidance specified in RG 1.20, Revision 3, consistent with the Fermi 3 reactor internals classification. A summary of the vibration analysis program and description of the vibration measurement (including measurement locations and analysis predictions) and inspection phases of the comprehensive vibration inspection program will be submitted to the NRC six months prior to implementation.

Commitment (COM 3.9-002):

Fermi 3 FSAR Section 3.9.3.1: The equipment stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1.

Commitment (COM 3.9-003):

Fermi 3 FSAR Section 3.9.3.7.1(3)f: For the ASME Class 1, 2, and 3 systems listed in DCD Tier 1, Section 3.1, that contain snubbers, a plant-specific table will be prepared in conjunction with the closure of the system-specific ITAAC for piping and component design and will include specific snubber information.

Commitment (COM 3.9-004):

Fermi 3 FSAR Section 3.9.3.1 on stress analysis: The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.

Commitment (COM 3.9-005):

Fermi 3 FSAR Section 3.9.3.7.1(3)f on specific snubber information: This information will be included in the FSAR as part of a subsequent FSAR update.

Commitment (COM 3.9-006):

Fermi 3 FSAR Section 3.9.2.4: For reactor internals other than the steam dryer, the preliminary and final reports (as necessary), which together summarize the results of the vibration analysis, measurement and inspection programs will be submitted to the NRC within 60 and 180 days, respectively, following the completion of the programs.

License Conditions

Part 10 of the Fermi 3 COL application specifies proposed license conditions in such technical areas as the steam dryer, explosively actuated valves, initial test program, and the operational program implementation schedule.

3.9.3 **Regulatory Basis**

The regulatory basis of the design-related information incorporated by reference is in NUREG-1966 and in a supplemental DCD FSER. In addition, the relevant requirements of the Commission regulations for the mechanical systems and components, and the associated acceptance criteria, are listed in Section 3.9 of NUREG-0800 and include the following:

- The guidance associated with the reactor internals startup testing is provided in RG 1.20, (Revision 3), "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing."

- 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 1, "Quality standards and records," which requires (in part) that components important to safety be designed, fabricated, erected, and, tested to quality standards commensurate with the importance of the safety functions to be performed.

- GDC 2, "Design bases for protection against natural phenomena," which requires (in part) that components important to safety be designed to withstand seismic events without a loss of capability to perform their safety functions.

- GDC 4, "Environmental and dynamic effects design bases," which requires that SSCs important to safety be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operations, maintenance, testing, and postulated pipe ruptures including loss-of-coolant accidents.

- GDC 14, "Reactor coolant pressure boundary," which requires that the RCPB be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage; rapidly propagating failures; and gross ruptures.

- GDC 15, "Reactor coolant system design," which requires that the reactor coolant system and associated auxiliary, control, and protection systems be designed with sufficient margins to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including anticipated operational occurrences.

- 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," as it relates to the suitability of the plant design bases for mechanical components established in consideration of site seismic characteristics.

The regulatory basis for the staff's review of the Fermi 3 FSAR is provided by 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a)(11) require that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME Boiler and Pressure Vessel Code (BPV Code) and the ASME OM Code, in accordance with 10 CFR 50.55a. As discussed in the ESBWR DCD FSER, GDC 1, 2, 4, 14, 15, 37, "Testing of emergency core cooling system"; 40, "Testing of containment heat removal system"; 43, "Testing of containment atmospheric cleanup system"; 46, "Testing of cooling water system"; and 54, "Piping systems penetrating containment"; in Appendix A to 10 CFR Part 50 establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. The quality assurance (QA) criteria in 10 CFR Part 50, Appendix B,

"Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," provide assurance that the design, tests, and documentation related to functional design, qualification, and inservice testing (IST) programs for pumps, valves, and dynamic restraints will comply with established standards and criteria; thereby ensuring that such equipment will be capable of performing the intended functions.

RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," provides guidance for a COL applicant in preparing and submitting the COL application in accordance with NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) that descriptions of operational programs need to be included in the FSAR for a COL application to allow reasonable assurance for a finding of acceptability. In particular, a COL applicant should fully describe the IST and other operational programs defined in Commission Paper SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," to avoid the need for ITAAC for operational programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms of scope and level of detail to allow a reasonable assurance finding. Further, operational programs should be described at a functional level with an increasing level of detail, where implementation choices could materially and negatively affect the program's effectiveness and acceptability. In the SRM for SECY-05-0197 dated February 22, 2006, the Commission approved the SECY—including the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR.

The staff's review of the Fermi 3 COL application followed the applicable guidance in SRP Section 3.9. Fermi 3 FSAR Table 1.9-201, "Conformance with Standard Review Plan," specifies that the COL application conform to the subsections in SRP Section 3.9. The staff also compared the Fermi 3 FSAR information with the guidance in RG 1.206, as listed in Fermi 3 FSAR Table 1.9-203, "Conformance with the FSAR Content Guidance in RG 1.206."

3.9.4 Technical Evaluation

As documented in NUREG–1966 and in the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134), the NRC staff reviewed and approved Section 3.9 of the ESBWR DCD. The staff reviewed Section 3.9 of the Fermi 3 COL FSAR and checked the referenced ESBWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ESBWR DCD appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information in the application and the information incorporated by reference address the relevant information related to this section.

[1] See "*Finality of Referenced NRC Approvals*" in SER Section 1.2.2, for a discussion on the staff's review related to verification of the scope of information to be included in a COL application that references a design certification.

The staff reviewed the information in the Fermi 3 COL FSAR as follows:

COL Items

- EF3 COL 3.9.9-1-A — Reactor Internals Vibration Analysis, Measurement and Inspection Program

DCD COL Item 3.9.9-1-A in Section 3.9.9 of the ESBWR DCD states that the COL applicant will perform the following:

(1) For the reactor internals, other than steam dryer, classify its reactor per the guidance in RG 1.20 and provide a milestone for submitting a description of the inspection and measurement programs to be performed (including measurement locations and analysis predictions) and the results of the vibration analysis, measurement and test program (Subsection 3.9.2.4).

(2) For the steam dryer, which is classified as a prototype per the guidance in RG 1.20, (a) provide a milestone of no later than 90 days before startup to prepare and provide to the NRC a Steam Dryer Monitoring Plan as described in NEDE-33313P, Section 10; (b) submit or reference a steam dryer predicted analysis (for the plant-specific or a sample steam dryer) that concludes the steam dryer will not exceed stress limits with applicable bias and uncertainties and the minimum alternating stress ratio (MASR) of 2.0; (c) describe startup program (with proposed license conditions) that includes appropriate notification points during power ascension, and submittal of the completed analysis of steam dryer data within 90 days following completion of the power ascension testing and monitoring of the steam dryer; and (d) specify periodic steam dryer inspections during refueling outages (Subsection 3.9.2.4).

To address COL Item 3.9.9-1-A, the applicant states in FSAR Subsection 3.9.2.4 that the vibration assessment program for reactor internals other than the steam dryer, as specified in RG 1.20, is provided in ESBWR DCD Appendix 3L and NEDE-33259P-A (ADAMS Accession Numbers ML091660432 (non-public proprietary version), ML091660433 (transmittal letter), and ML091660434 (public version)). In addition, the classification of the Fermi 3 reactor internals in accordance with RG 1.20 is dependent on the ESBWR status (i.e., whether Fermi 3 or another reactor before Fermi 3 is the initial ESBWR to test the reactor internals).

Specific to the steam dryer, the comprehensive vibration assessment program, as specified in RG 1.20 is provided in ESBWR DCD Appendix 3L, NEDE-33312P (ADAMS Accession Number ML13344B163), NEDE-33313P (ADAMS Accession Number ML13344B164), and NEDE-33408P (ADAMS Accession Number ML13344B176).

The steam dryer is classified as a prototype according to RG 1.20, Revision 3, and the applicant presents an approach that is consistent with RG 1.20 and Section 10.2 of NEDE-33313P, including four elements of a steam dryer Comprehensive Vibration Assessment Program (CVAP) that must be addressed.

The staff reviewed the classification of the Fermi 3 reactor internals. The Fermi 3 classification of the reactor internals has two scenarios. In the first scenario, the Fermi 3 reactor internals are classified as the ESBWR prototype for testing the reactor internals. In the second scenario,

should a CVAP for an ESBWR unit other than Fermi 3 be completed and approved by the NRC as a valid prototype before the initiation of startup testing at Fermi 3, the Fermi 3 reactor internals will be classified as non-prototype Category I. As described in the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) for ESBWR DCD Tier 2, Section 3.9.5, the steam dryer will be classified as a prototype regardless of the presence of another ESBWR unit. The staff finds the classification approach for the Fermi 3 reactor internals to be acceptable because the classification of the reactor internals for Fermi 3 is consistent with RG 1.20, and the classification of the steam dryer as a prototype regardless of the presence of another ESBWR unit is conservative.

For reactor internals (other than the steam dryer) to be installed in Fermi 3, the staff finds the review and acceptance of the CVAP specified in the ESBWR DCD to be acceptable as described in the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) for ESBWR DCD Tier 2, Section 3.9.5. Therefore, the staff finds the portion of COL Item 3.9.9-1-A related to the reactor internals (other than the steam dryer) for Fermi 3 to be satisfied.

For the steam dryer, a description of the staff's review and acceptance of the ESBWR steam dryer evaluation methodology is in the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) for ESBWR DCD Tier 2, Section 3.9.5. The Fermi 3 FSAR specifies the COL applicant's actions that are necessary to satisfy the portion of COL Item 3.9.9-1-A related to the steam dryer. For the Fermi 3 steam dryer —Item (a) of COL Item 3.9.9-1-A— the CVAP to be applied is described in ESBWR DCD Tier 2, Section 3.9 and Appendix 3L and in NEDE-33313P, Section 10.0. The CVAP includes preparing and submitting to the NRC a Steam Dryer Monitoring Plan (SDMP) no later than 90 days before startup. For Item (b) of COL Item 3.9.9-1-A, the detailed design of the Fermi 3 steam dryer will follow the methodology described in DCD Appendix 3L and in the incorporated engineering reports. As described in NEDE-33313P, Section 10.2(b), an example of a steam dryer predictive analysis that concludes the steam dryer will not exceed stress limits with the applicable bias and uncertainties and the minimum alternating stress ratio of 2.0 is provided in NEDE-33408P. The example of an as-designed steam dryer that was subject to the predictive analysis process and successful startup testing described in NEDE-33408P serves as the design analysis report for the steam dryer and provides sufficient information for licensing. For Item (c) of COL Item 3.9.9-1-A, the Fermi 3 startup program is based on NEDE-33313P, Section 10.2(c), which includes (1) providing appropriate notification points during power ascension; (2) providing data to the NRC at certain hold points and at full power; and (3) providing a full stress analysis report and evaluation to the NRC within 90 days of reaching the full power level. For Item (d) of COL Item 3.9.9-1-A, the periodic steam dryer inspection program for Fermi 3 during refueling outages is described in NEDE-33313P, Section 10.2(d). Part 10 of the Fermi 3 COL application provides a proposed license condition for the steam dryer startup program and the periodic inspection program.

The NRC staff has reviewed the actions specified in the Fermi 3 FSAR for each of the individual portions of COL Item 3.9.9-1-A regarding the steam dryer. The staff determined that the Fermi 3 FSAR actions related to the steam dryer satisfy the provisions in ESBWR DCD Tier 2 and NEDE-33312P, NEDE-33313P, and NEDE-33408P incorporated in the ESBWR DCD as accepted in the NRC Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) on ESBWR DCD Tier 2, Section 3.9.5. These Fermi 3 actions include application of the CVAP for the steam dryer described in the ESBWR DCD Tier 2 and NEDE-33313P, reference of the example steam dryer predictive analysis in NEDE-33408P, preparation of a Fermi 3 startup program that incorporates the steam dryer monitoring plan in NEDE-33313P, and specification of a periodic steam dryer inspection program consistent with NEDE-33313P. The Fermi 3 steam dryer monitoring and inspection program will be verified by

the license condition specified later in this SER section. The staff reviewed and accepted the ESBWR DCD and its referenced engineering reports on the steam dryer as part of the NRC review of the ESBWR design certification application. Therefore, the staff finds that the actions specified by the Fermi 3 COL applicant satisfy the steam dryer portion of COL Item 3.9.9-1-A.

The NRC staff notes that the ESBWR DCD identifies specific portions of the information on the structural integrity and functional capability of mechanical systems and components to be Tier 2* information. As part of this identification of Tier 2* information, the ESBWR DCD identifies Tier 2, Section 3.9.2.3 as well as the GEH engineering reports NEDE-33312P, NEDE-33313P, and NEDE-33408P on the ESBWR steam dryer incorporated by reference in the DCD as Tier 2* in their entirety. Therefore, the Fermi 3 steam dryer evaluation methodology will be implemented as Tier 2* information in accordance with the ESBWR design certification.

In FSAR Subsection 3.9.2.4, the Fermi 3 COL applicant identifies two commitments—COM 3.9-001 and COM 3.9-006—related to the development of a comprehensive vibration assessment and the associated reports. The NRC staff finds that the commitments are consistent with the provisions in the ESBWR DCD as accepted by the NRC as part of its ESBWR design certification review. These commitments provide an additional mechanism for additional licensee tracking of activities related to the comprehensive vibration assessment program. The NRC staff has reviewed and approved this program under the ESBWR DCD; in addition, license conditions exist for the most critical elements of the program related to the steam dryer, and license conditions and NRC inspections are already planned in conjunction with the initial test program. Therefore, the use of a commitment to track completion of these activities is acceptable.

Based on the review described above, the staff finds that the Fermi 3 COL applicant has satisfied the provisions in COL Item COL 3.9.9-1-A. The staff discusses the applicable license conditions related to reactor internals for Fermi 3 later in this SER section. The staff finds that the information related to reactor internals classification and testing adequately meets RG 1.20 guidance and NRC regulatory requirements and is thus acceptable.

- STD COL 3.9.9-2-A — ASME Class 2 or 3 or Quality Group D Components with 60-Year Design Life

DCD COL Item 3.9.9-2-A in Section 3.9.9 of the ESBWR DCD states the following:

> The COL Applicant will provide a milestone for completing the required equipment stress reports, per ASME BPV Code, Subsection NB, for equipment segments that are subject to loadings that could result in thermal or dynamic fatigue and for updating the FSAR, as necessary, to address the results of the analysis (Subsection 3.9.3.1).

Fermi 3 COL FSAR Revision 6, Subsection 3.9.3.1, “Loading Combinations, Design Transients and Stress Limits,” states that the required equipment stress reports will be completed within 6 months of the completion of DCD ITAAC Table 3.1-1 (Commitment 3.9-002). In addition, the Fermi 3 FSAR specifies that the FSAR will be revised as necessary in a subsequent update to address the results of this analysis in Commitment 3.9-004. The staff observes that in order to complete the referenced ITAAC related to the pipe break analyses listed in DCD Tier 1, Table 3.1-1, the applicant will first perform equipment and piping stress analyses that support the determination of pipe break locations. Additional ITAAC related to the completion of component and piping stress analyses in accordance with ASME BPV Code requirements are in

DCD Tier 1. Furthermore, in both a public teleconference on February 20, 2014 (ADAMS Accession Number ML14078A005), and a letter dated February 28, 2014 (ADAMS Accession Number. ML14064A283), the applicant clarified that there are currently no non-Class 1 components subjected to cyclic loadings of a magnitude and/or duration so severe that the 60-year design life cannot be assured. Therefore, the staff finds that no supplemental information that provides an analysis or design per the Tier 2* provisions of ESBWR DCD, Tier 2, Subsection 3.9.3.1, is necessary at this time. The staff also observes that the original basis for including these requirements in the ESBWR DCD related to the NRC staff's concerns regarding environmentally assisted fatigue, which have been resolved through the final staff position in RG 1.207, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due To the Effects of the Light-Water Reactor Environment for New Reactors," which is committed to in ESBWR DCD Tier 2, Section 3.9.1. Therefore, the applicant has provided an acceptable milestone related to the development of the required equipment stress reports, as requested in the COL item. The use of Commitments 3.9-002 and 3.9-004 to track these activities is acceptable to the staff, as they address one detail of the overall stress analysis that will be confirmed through completion of ITAAC related to ASME BPV Code requirements, as well as periodic FSAR updates required by the regulations. Licensing and inspection processes are already in place to provide final verification of these overall activities. Based on the provision of a reasonable milestone in response to the COL item and the associated ITAAC, the staff thus finds the applicant's response to COL Item 3.9.9-2-A acceptable.

- STD COL 3.9.9-3-A Inservice Testing Programs

This COL item is related to the functional design, qualification, and IST Programs for pumps, valves, and dynamic restraints. The NRC staff reviewed the Fermi 3 COL application and the applicable sections in the ESBWR DCD incorporated by reference in the Fermi 3 FSAR for the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints to determine whether the Fermi 3 COL application meets the regulatory requirements to provide reasonable assurance that the applicable safety-related components at Fermi 3 will be capable of performing their safety functions. In response to RAIs on the ESBWR design certification (DC) application, GEH revised the ESBWR DCD to specify provisions for the IST Programs to support COL applications referencing the ESBWR design. Detroit Edison notified the NRC in letters dated February 16, 2009; July 19, 2010; and September 21, 2010 (ADAMS Accession Numbers ML102660145, ML090620123, and ML102660145, respectively), that Detroit Edison had assumed the role of the reference COL (R-COL) application for the ESBWR design and adopted the RAI responses related to FSAR Section 3.9.6 provided by Dominion Power for the previous R-COL application plant. The staff's review of the description of the IST Programs for Fermi 3 is as follows:

COL Item 3.9.9-3-A in Section 3.9.9 of the ESBWR DCD states the following:

> The COL Applicant shall provide a full description of the IST Program and a milestone for full program implementation as identified in Subsection 3.9.6.1.

The staff reviewed Section 3.9.6 of the ESBWR DCD. The staff's technical evaluation included the information incorporated by reference related to the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints. The evaluation is documented in the staff's FSER for the ESBWR DC application (NUREG–1966). ESBWR DCD Tier 2, Section 3.9.6 provides a general description of the IST Operational Programs to be developed for an ESBWR plant.

ESBWR DCD Subsection 3.9.3.5, “Valve Operability Assurance,” describes the process for the functional design and qualification of valves to be used in the ESBWR. Subsection 3.9.3.5 in ESBWR DCD Tier 2 specifies that valve designs not previously qualified will meet the requirements of ASME Standard QME-1-2007, “Qualification of Active Mechanical Equipment Used in Nuclear Power Plants.” For valve designs previously qualified to standards other than ASME QME-1-2007, ESBWR DCD Tier 2, Subsection 3.9.3.5 specifies an approach for valve qualification that follows the key principles of ASME QME-1-2007. The Fermi 3 FSAR incorporates by reference this section of the ESBWR DCD without supplemental information. The NRC issued Revision 3 to RG 1.100, “Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants,” which accepts the use of ASME QME-1-2007 for the functional design and qualification of pumps, valves, and dynamic restraints, with certain conditions. Based on the lessons learned from valve research and operating experience incorporated in ASME QME-1-2007 as accepted in Revision 3 to RG 1.100, the staff found the provisions in the ESBWR DCD for the functional design and qualification of safety-related valves to be acceptable.

ESBWR DCD Tier 2, Section 3.9.6, “Inservice Testing of Pumps and Valves,” provides a general description of the IST Program to be developed for an ESBWR plant. DCD Tier 2, Table 1.9-22 specifies that the ASME OM Code (2001 Edition through the 2003 Addenda) is the basis for the IST Program to be described in COL applications referencing the ESBWR design. ESBWR DCD Tier 2, Table 3.9-8, “Inservice Testing,” provides a list of the valves and other information to be included in the IST Program for an ESBWR plant, such as the valve number; quantity; description; valve and actuator type; ASME Code Class and category; valve function; normal, safety, and fail-safe positions; containment isolation function; and test parameters and frequencies. The ESBWR does not include safety-related, motor-operated valves (MOVs).

As part of the response to COL Item 3.9.9.3-A, the applicant provides supplemental information in the Fermi 3 FSAR on the IST Program for Fermi 3. For example, the Fermi 3 FSAR describes the overall IST Program, preservice testing, power-operated valve testing, and check valve testing. The Fermi 3 COL FSAR does not identify any additional plant-specific valves to be included in the IST Program beyond those listed in ESBWR DCD Tier 2, Table 3.9-8. ESBWR DCD Tier 2, Subsection 3.9.6.1.4, “Valve Testing,” references NUREG–1482 (Revision 1), “Guidelines for Inservice Testing at Nuclear Power Plants.” Following the issuance of the Fermi 3 COL, the guidance in NUREG–1482 (Revision 2 issued in October 2013) can be used to develop the IST Program for Fermi 3, including the specific information to be included in IST Program documentation and tables for NRC inspection.

The staff reviewed the description of the ASME OM Code requirements in the Fermi 3 FSAR on the IST Program that supplements the provisions in the ESBWR DCD. For example, Fermi 3 FSAR Subsection 3.9.6.1 describes the IST provisions for the (a) establishment of reference values; (b) prohibition of preconditioning that undermines the purpose of IST activities; (c) comparisons of stroke time to the reference value, except for fast-acting valves assigned a stroke time limit of 2 seconds; (d) testing of solenoid-operated valves; (e) preoperational testing of check valves; (f) acceptance criteria for check valve tests; (g) use of nonintrusive techniques for check valve tests; (h) test conditions for the check valve tests; (i) post-maintenance testing for the check valves; (j) check valve disassembly and testing; (k) re-establishment of reference values following maintenance; and (l) valve replacement, repair, and maintenance. The staff finds the Fermi 3 FSAR to be consistent with Subsection ISTC, “Inservice Testing of Valves in Light-Water Reactor Nuclear Power Plants,” of the ASME OM Code incorporated by reference

in 10 CFR 50.55a, and therefore, the FSAR description of the use of ASME OM Code, Subsection ISTC, is acceptable.

ESBWR DCD Tier 2, Section 3.9.6 specifies that the IST of the applicable ASME BPV Code, Section III, Class 1, 2, and 3 pumps and valves will be performed in accordance with the ASME OM Code required by 10 CFR 50.55a(f), including limitations and modifications set forth in 10 CFR 50.55a. ESBWR DCD Tier 2, Section 3.9.10, "References," specifies the application of the 2001 Edition with the 2003 Addenda of the ASME OM Code for use in the ESBWR design. The Fermi 3 FSAR incorporates these provisions by reference in the ESBWR DCD.

Supplemental Information STD SUP 3.9-1 to Fermi 3 FSAR Subsection 3.9.6.6 specifies that no relief from or alternative to the ASME OM Code is being requested beyond what is identified in the DCD. The ASME OM Code (2001 Edition through 2003 Addenda) is incorporated by reference in 10 CFR 50.55a of the NRC regulations with certain limitations and modifications. Therefore, the staff considers the application of the ASME OM Code, 2001 Edition through 2003 Addenda, as specified in the NRC regulations with applicable limitations and modifications, to be acceptable for the Fermi 3 IST Program description. As specified in 10 CFR 50.55a, a COL licensee is required to incorporate in the IST Program the latest edition and addenda of the ASME OM Code approved in 10 CFR 50.55a(f), on the date 12 months before initial fuel load.

The ESBWR DCD specifies that the ESBWR reactor design does not require the use of pumps to mitigate the consequences of design-basis accidents or to achieve or maintain a safe-shutdown condition. Therefore, the IST Program for the ESBWR design does not include any pumps. As indicated in a GEH response to RAI 3.9-152 (MFN 06-489) dated November 30, 2006 (ADAMS Accession Number ML063460294), post-accident long-term decay heat removal for the ESBWR is performed by nonsafety-related systems as accepted in Commission paper SECY-94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-safety Systems [RTNSS] in Passive Plant Designs." The availability of systems relied on after 72 hours that is addressed under the RTNSS Program is discussed in Chapter 19.0, "Probabilistic Risk Assessment and Severe Accidents," of the Fermi 3 SER.

In RAI 03.09.06-1 for the previous R-COL application plant, the staff requested Dominion to discuss the process for implementing the provisions specified in ESBWR DCD Tier 2, Subsection 3.9.3.5 for the functional design and qualification of valves and dynamic restraints. In a letter dated February 16, 2009 (ADAMS Accession Number ML090620123), Detroit Edison adopted Dominion's RAI response dated September 11, 2008, specifying that GEH is responsible for the design and qualification of mechanical equipment including valves and dynamic restraints. In July 2009, the staff conducted an audit of the design and procurement specifications for valves and environmental qualification at the GEH office in Wilmington, NC. The purpose of the audit was to confirm the implementation of the ESBWR DCD provisions for the design and qualification of applicable pumps, valves, and dynamic restraints and to support the full description of the IST and environmental qualification (EQ) operational programs provided by COL applicants. As discussed in an NRC memorandum dated September 1, 2009 (ADAMS Accession Number ML092390403) documenting the results of the July 2009 audit, the staff reviewed ESBWR DCD IST Table 3.9-8 and several design and purchase specifications for various valve types. The audit identified specific provisions of the ESBWR DCD IST Table and component specifications that needed to be clarified regarding aspects such as the valve types identified in the IST Program Table and the consideration of lessons learned from valve operating experience. In the response to the audit follow-up items in a letter dated September 21, 2009 (ADAMS Accession Number ML092650083), GEH indicated that the ESBWR DCD IST Table and component specifications would be revised to incorporate the

necessary clarifications identified during the audit. In a letter dated November 12, 2009 (ADAMS Accession Number. ML093170020), GEH discussed its review of Revision 3 to RG 1.100 for any necessary modifications to its valve specifications that reference the application of ASME Standard QME-1-2007. As indicated in the GEH response to the audit follow-up actions, GEH revised the ESBWR DCD (beginning with Revision 6) to include the necessary clarifications to the DCD IST Table identified during the audit. On March 19, 2010, the staff conducted a follow-up audit at the GEH office in Washington, DC, to review the implementation of the actions specified by GEH in the letter dated September 21, 2009. Based on that GEH letter and the NRC follow-up audit conducted on March 19, 2010, the staff considers that GEH has resolved the audit follow-up actions related to the functional design and qualification of valves in support of the ESBWR DCD. The staff finds that the ESBWR DCD provisions for the functional design and qualification of valves are being implemented in the component specifications in an adequate manner to support the Fermi 3 COL application. Therefore, RAI 03.09.06-1 is resolved.

In RAI 03.09.06-2 for the previous R-COL application plant, the staff requested Dominion to clarify the ASME OM Code edition and addenda that are the basis for the IST Program described in the COL application. In a letter dated February 16, 2009 (ADAMS Accession Number ML090620123), Detroit Edison adopted Dominion's RAI response dated September 11, 2008, which indicates that the ASME OM Code, 2001 Edition with the 2003 Addenda, is the basis for the IST Program for the R-COL application plant. The staff finds that the RAI response clarifies the specific ASME OM Code edition and addenda to be used in describing the IST Program for the Fermi 3 COL application. Therefore, RAI 03.09.06-2 is resolved.

RAI 03.09.06-3 for the previous R-COL application plant requested Dominion to discuss (1) the provisions in the FSAR for the periodic verification of air-operated valve (AOV) capability; (2) the application of lessons learned from valve performance to power-operated valves (POVs) other than AOVs; and (3) the basis for the statement in FSAR Section 3.9.6 that post-maintenance procedures are applied where high-risk valve performance could be affected. In a letter dated February 16, 2009 (ADAMS Accession Number ML090620123), Detroit Edison adopted Dominion's RAI response dated September 11, 2008, which discussed the IST Program for AOVs and other POVs (with the exception of safety-related MOVs, which are not used in the ESBWR design). As a result, Fermi 3 FSAR Section 3.9.6 describes the incorporation of lessons learned from valve experience at operating nuclear power plants into the AOV IST Program for Fermi 3. The Fermi 3 FSAR supplements the ESBWR DCD with a description of the testing program for POVs to be used at Fermi 3. For example, the AOV program will include the key elements of the Joint Owners Group AOV Program discussed in RIS 2000-03, which also references the staff's comments on the program. Among the key lessons learned in the AOV Program, the Fermi 3 FSAR specifies that periodic dynamic testing of AOVs will be performed (if necessary) to re-verify the capability of the valve to perform its required functions based on valve qualification or operating experience. The Fermi 3 FSAR states that the attributes of the AOV Testing Program are applied to other POVs to the extent that they apply to and can be implemented for those valves. The Fermi 3 FSAR also clarifies that post-maintenance procedures ensure that baseline testing is re-performed as necessary, when maintenance on the valve (such as valve repair or replacement) has the potential to affect valve functional performance. The staff finds that the provisions included in the Fermi 3 FSAR to supplement the ESBWR DCD are sufficient to apply the lessons learned from valve testing to the POV Testing Program at Fermi 3. Therefore, RAI 03.09.06-3 is resolved.

ESBWR DCD Tier 2, Subsection 3.9.3.7, “Component Supports,” discusses piping supports; spring hangers; struts; and snubbers (dynamic restraints). To address COL Item 3.9.9-4 A, the Fermi 3 FSAR provides supplemental information on the snubber Inservice Examination and Testing Program. In particular, the Fermi 3 FSAR specifies that the program will satisfy ASME OM Code, Subsection ISTD, and provides specific examples of the program content to supplement the ESBWR DCD.

ESBWR DCD Tier 2, Subsection 3.9.3.7.1, “Piping Supports,” specifies provisions for snubber design, testing, installation, and preservice examination and testing. For example, ESBWR DCD Tier 2, Subsection 3.9.3.7.1 states in paragraph c, “Snubber Design and Testing,” that the codes and standards used for snubber qualification and production testing are the ASME BPV Code (Section III and Subsection NF); the ASME OM Code (Subsection ISTD); and the ASME Standard QME-1-2007 (Subsection QDR). ESBWR DCD Tier 2, Subsection 3.9.3.7.1 states in paragraph e, “Snubber Pre-service and In-service Examination and Testing,” that the COL applicant will provide a full description of the snubber IST Program. In ESBWR DCD Tier 2, Section 3.9.9, COL Item STD COL 3.9.9-4-A specifies that the COL applicant shall provide a full description of the snubber preservice and inservice inspection and testing programs and a milestone for program implementation, including development of a data table identified in Subsection 3.9.3.7.1(3)f. Fermi 3 FSAR Section 3.9.9 states that COL Item STD COL 3.9.9-4-A is discussed in Subsections 3.9.3.7.1(3)e and f. Table 1.9-203 in the Fermi 3 FSAR states that the COL application conforms to paragraph C.III.1.3.9.6.4 of RG 1.206, with the exception that a plant-specific snubber table will be prepared in conjunction with the closure of ITAAC Table 3.1-1. Section 3.9 in the Fermi 3 FSAR describes the snubber Inservice Examination and Testing Program. This description specifies that the program will satisfy ASME OM Code, Subsection ISTD, and includes specific examples of the program content to supplement the ESBWR DCD. The staff reviewed the description of the IST Program for dynamic restraints in comparison to ASME OM Code, Subsection ISTD. As discussed below regarding COL Item 3.9.9-4-A, the staff has reviewed the description of the snubber Inservice Examination and Testing Program provided in the Fermi 3 FSAR and the referenced provisions in the ESBWR DCD. The staff determined that the description of the Fermi 3 snubber Inservice Examination and Testing Program is consistent with the ASME OM Code, Subsection ISTD, as incorporated by reference in 10 CFR 50.55a. Therefore, the staff finds that the Fermi 3 FSAR and the ESBWR DCD provide an acceptable description of the Operational Program for Dynamic Restraints at Fermi 3 in support of the Fermi 3 COL application.

In RAI 03.09.06-4 for the previous R-COL application plant, the staff requested Dominion to clarify the reference to ASME BPV Code, Section XI, with respect to snubbers that are described in paragraph 3(b) of ESBWR DCD Tier 2, Subsection 3.9.3.7.1. In a letter dated February 16, 2009 (ADAMS Accession Number ML090620123), Detroit Edison adopted Dominion’s RAI response dated September 11, 2008, which referenced an RAI response from GEH indicating that the specifications referring to ASME BPV Code, Section XI, would be deleted from this section in ESBWR DCD Tier 2. Subsequently, the staff found that the revised ESBWR DCD Tier 2 is consistent with the RAI response. Therefore, RAI 03.09.06-4 is resolved.

Fermi 3 FSAR Section 13.4 indicates that FSAR Table 13.4-201, “Operational Programs Required by NRC Regulations,” lists each operational program; the regulatory source for the program; the associated implementation milestones; and the FSAR section that fully describes the operational program (as discussed in RG 1.206). FSAR Table 13.4-201 specifies the implementation milestone for the IST Program as “after generator online on nuclear heat.” The implementation milestone for the Preservice Testing (PST) Program is specified as “prior to fuel

load." A note in FSAR Table 13.4-201 specifies that the "snubber inservice examination is initially performed not less than two months after attaining 5% reactor power operation and will be completed within 12 calendar months after attaining 5% reactor power."

In RAI 03.09.06-5 for the previous R-COL application plant, the staff requested Dominion to discuss the commencement of the PST Program. In a letter dated February 16, 2009 (ADAMS Accession No. ML090620123), Detroit Edison adopted Dominion's RAI response dated September 11, 2008, which states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule that supports planning for and conducting NRC inspections of operational programs (including the PST Program). The schedule will be submitted 12 months after the issuance of the COL and will be updated every 6 months until 12 months before the scheduled fuel loading, and every month thereafter until either the operational programs listed in FSAR Table 13.4-201 are fully implemented or the plant is placed in commercial service—whichever comes first. According to the RAI response, commencement of PST will be concurrent with the operational status of the equipment and the readiness to support PST, with completion of the PST before fuel load as indicated in FSAR Table 13.4-201. This provision is indicated to mean, for example, that the installation of the valves in the piping system must be complete—along with most of the piping system—when the valve power and controls are in place to support valve operation. Further, any post-installation construction testing and valve setup activities (such as setting torque or limit switches; lubricating the valve; packing installation; or adjustment) must be complete. The accomplishment of these activities will depend on the plant construction and turnover schedules. The staff finds that the RAI response clarifies the commencement of the PST Program. As discussed later in this SER section, the licensee will submit a schedule that supports planning and conducting NRC inspections of operational programs, including the PST Program listed in Fermi 3 FSAR Table 13.4-201. Based on this license condition (License Condition 03.09-01), the staff will be aware of the commencement of the PST Program in preparation for NRC inspection activities. Therefore, RAI 03.09.06-5 is resolved.

In RAI 03.09.06-6 for the previous R-COL application plant, the staff requested Dominion to describe the planned implementation of the program to address potential adverse flow effects on safety-related valves and dynamic restraints within the IST Program in the reactor coolant, steam and feedwater systems from hydraulic loading and acoustic resonance during plant operation. In a letter dated February 16, 2009 (ADAMS Accession Number ML090620123), Detroit Edison adopted Dominion's RAI response dated September 11, 2008, (ADAMS Accession Number ML082730754) stating the intent to use the overall Initial Test Program (ITP) (including preoperational and startup testing) to address potential adverse flow effects on safety-related valves and dynamic restraints. As discussed in the RAI response , the objective of the program is to confirm the attributes of the component design as indicated in the ESBWR DCD, with implementation described in FSAR Section 14.2 and Table 13.4-201. ESBWR DCD Tier 2, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment," addresses criteria; testing procedures; and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports under vibratory loadings. ESBWR DCD Tier 2, Subsection 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," states that the overall testing program is divided into the preoperational test phase and the initial startup test phase where piping vibration, thermal expansion, and dynamic effects testing are performed during both phases, as described in ESBWR DCD Tier 2, Chapter 14. ESBWR DCD Tier 2, Subsection 3.9.2.1.1, "Vibration and Dynamic Effects Testing," states that the purpose of these tests is to confirm that the piping, components, restraints, and supports of specified high and

moderate energy systems have been designed to withstand the dynamic effects of steady-state flow-induced vibration (FIV) and anticipated operational transient conditions. The DCD specifies that vibration testing will be performed in accordance with ANSI/ASME OM-S/G-1990, Part 3, "Requirements for Preoperational and Initial Start-up Vibration Testing of Nuclear Power Plant Piping Systems." ESBWR DCD Tier 2, Subsection 3.9.3.5 requires valve specifications to incorporate lessons learned from nuclear power plant operations and research programs—including applicable load combinations. ESBWR DCD Tier 2, Subsections 3.9.3.7 and 3.9.3.8 require analyses or tests for component supports to assure that their structural capability will withstand seismic and other dynamic excitations. ESBWR DCD Tier 2, Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," addresses methods of testing and analyses employed to ensure the operability of mechanical and electrical equipment under the full range of normal and accident loadings, to ensure conformance with NRC regulations. ESBWR DCD Tier 2, Subsection 14.2.8.1.42, "Expansion, Vibration and Dynamic Effects Preoperational Test," states that its objective is to verify that critical components and piping runs are properly installed and supported, so that expected steady-state and transient vibration and movement due to thermal expansion do not result in excessive stress or fatigue to safety-related plant systems and equipment. ESBWR DCD Tier 2, Subsection 14.2.8.2.10, "System Vibration Test," describes the applicable preoperational and startup tests for plant systems.

Based on the above information, the staff finds that the ESBWR DCD includes provisions to address potential adverse flow effects for safety-related valves and dynamic restraints at Fermi 3 that reflect nuclear power plant operating experience. The staff reviewed the qualification provisions for potential adverse flow effects as part of the audit of ESBWR design and procurement specifications discussed in this SER section. In Part 10, "ITAAC," of the Fermi 3 COL application, the Fermi 3 COL applicant in Section 3.2, "License Conditions for Initial Test Program," specifies a detailed license condition related to the startup administrative manual, preoperational and startup test procedures, power ascension test phase reports, and test changes. In Chapter 14.0, "Initial Test Program," of this SER, the staff describes its review of the Fermi 3 initial test program including the proposed license conditions in Part 10 of the Fermi 3 COL application. The Fermi 3 COL applicant's use of the ITP to address potential adverse flow effects on plant components through implementation of the provisions in ESBWR DCD Tier 2, Chapter 14 will be verified as part of future NRC inspections at Fermi 3. Therefore, RAI 03.09.06-6 is resolved.

Subsection ISTC-5260, "Explosively Actuated Valves," in the ASME OM Code specifies that at least 20 percent of the charges in explosively actuated (i.e., squib) valves shall be fired and replaced at least once every 2 years. If a charge fails to fire, the ASME OM Code states that all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch. In light of the updated design and safety significance of squib valves in new reactors, the need for improved surveillance activities for squib valves is being considered by the nuclear industry; ASME; and U.S. and international nuclear regulators. In RAI 03.09.06-1 for the Fermi 3 COL application, the staff requested Detroit Edison to describe its plans for addressing the surveillance of squib valves that will provide reasonable assurance of the operational readiness of those valves to perform their safety functions in support of the Fermi 3 COL application. In a letter dated November 9, 2010 (ADAMS Accession Number ML103140611), Detroit Edison submitted a planned revision to Fermi 3 COL FSAR Section 3.9.6 to specify that industry and regulatory guidance will be considered in the development of the IST Program for squib valves. Detroit Edison indicated that the FSAR would also state that the IST Program for squib valves will incorporate lessons learned from the design and

qualification process for these valves, such that surveillance activities provide reasonable assurance of the operational readiness of squib valves to perform their safety functions. The staff found that the planned changes to the Fermi 3 COL FSAR are sufficient to describe the IST Program for squib valves for incorporating the lessons learned from the design and qualification process in developing surveillance activities that will provide reasonable assurance of the operational readiness for squib valves to perform their safety functions. In Fermi 3 COL FSAR (Revision 3 through Revision 6), Subsection 3.9.6.1.4, "Valve Testing"; Item (4), "Special Tests," includes the provisions for surveillance of squib valves as specified in the RAI response. Therefore, RAI 03.09.06-1 is closed.

As discussed later in this SER section, the staff has prepared License Condition 03.09-2 directing the implementation of a surveillance program for squib valves in the gravity-driven cooling system and the automatic depressurization system at Fermi 3 prior to fuel load to supplement the IST requirements in the ASME OM Code, consistent with the licensing of other passive design new reactors. The staff considers the application of the ASME OM Code as incorporated by reference in 10 CFR 50.55a prior to startup of Fermi 3 to be sufficient for squib valves in the standby liquid control (SLC) system at Fermi 3, without the additional provisions of License Condition 03.09-2 that are necessary for the gravity driven cooling system and automatic depressurization system, based on operating experience with SLC squib valves in current boiling-water reactor nuclear power plants.

- STD COL 3.9.9-4-A Snubber Inspection and Test Program

DCD COL Item 3.9.9-4-A in Section 3.9.9 of the ESBWR DCD states the following:

> The COL Applicant shall provide a full description of the snubber preservice and inservice inspection and testing programs, and a milestone for program implementation, including development of a data table identified in Subsection 3.9.3.7.1(3)f (Subsection 3.9.3.7.1(3)e).

The staff reviewed the applicant's information related to the snubber preservice and inservice examination and testing programs included under Subsection 3.9.3.7.1(3)e of the Fermi 3 COL FSAR, which states the following:

> A preservice thermal movement examination is also performed; during initial system heatup and cooldown, for systems whose design operating temperature exceeds 121°C (250°F), snubber thermal movement is verified.
>
> Additionally, preservice operational readiness testing is performed on all snubbers. The operational readiness test is performed to verify the parameters of ISTD-5120. Snubbers that fail the preservice operational readiness test are evaluated to determine the cause of failure, and are retested following completion of corrective action(s).
>
> Snubbers that are installed incorrectly or otherwise fail preservice testing requirements are re-installed correctly, adjusted, modified, repaired or replaced, as required. Preservice examination and testing is re-performed on installation-corrected, adjusted, modified, repaired or replaced snubbers as required.
>
> Inservice examination and testing of all safety-related snubbers is conducted in accordance with the requirements of the ASME OM Code, Subsection ISTD.

Inservice examination is initially performed not less than two months after attaining 5 percent reactor power operation and will be completed within 12 calendar months after attaining 5 percent reactor power. Subsequent examinations are performed at intervals defined by ISTD-4252 and Table ISTD-4252-1. Examination intervals, subsequent to the third interval, are adjusted based on the number of unacceptable snubbers identified in the then current interval.

An inservice visual examination is performed on all snubbers to identify physical damage, leakage, corrosion, degradation, indication of binding, misalignment or deformation and potential defects generic to a particular design. Snubbers that do not meet visual examination requirements are evaluated to determine the root cause of the unacceptability, and appropriate corrective actions (e.g., snubber is adjusted, repaired, modified, or replaced) are taken. Snubbers evaluated as unacceptable during visual examination may be accepted for continued service by successful completion of an operational readiness test.

Snubbers are tested inservice to determine operational readiness during each fuel cycle, beginning no sooner than 60 days before the scheduled start of the applicable refueling outage. Snubber operational readiness tests are conducted with the snubber in the as-found condition, to the extent practical, either in place or on a test bench, to verify the test parameters of ISTD-5210. When an in-place test or bench test cannot be performed, snubber subcomponents that control the parameters to be verified are examined and tested. Preservice examinations are performed on snubbers after reinstallation when bench testing is used (ISTD-5224), or on snubbers where individual subcomponents are reinstalled after examination (ISTD-5225).

Defined test plan groups (DTPG) are established and the snubbers of each DTPG are tested according to an established sampling plan each fuel cycle. Sample plan size and composition are determined as required for the selected sample plan, with additional sampling as may be required for that sample plan based on test failures and failure modes identified. Snubbers that do not meet test requirements are evaluated to determine root cause of the failure, and are assigned to failure mode groups (FMG) based on the evaluation, unless the failure is considered unexplained or isolated. The number of unexplained snubber failures not assigned to an FMG determines the additional testing sample. Isolated failures do not require additional testing. For unacceptable snubbers, additional testing is conducted for the DTPG or FMG until the appropriate sample plan completion criteria are satisfied.

Unacceptable snubbers are adjusted, repaired, modified, or replaced. Replacement snubbers meet the requirements of ISTD-1600. Post-maintenance examination and testing, and examination and testing of repaired snubbers, is done to ensure that test parameters that may have been affected by the repair or maintenance activity are verified acceptable.

Service life for snubbers is established, monitored and adjusted as required by ISTD-6000 and the guidance of ASME OM Code, Non-mandatory Appendix F.

In Commitment 3.9-003, the Fermi 3 applicant specifies in the Fermi 3 FSAR that for the ASME Class 1, 2, and 3 systems listed in DCD Tier 1, Section 3.1, that contain snubbers, a plant-specific table will be prepared in conjunction with the closure of the system-specific ITAAC for piping and component design and will include specific snubber information.

In Commitment 3.9-005, the Fermi 3 applicant specifies in the Fermi 3 FSAR that this information will be included in the FSAR as part of a subsequent FSAR update.

The staff finds that the provisions specified in the Fermi 3 FSAR on the snubber inspection and test program together with the ESBWR DCD provisions incorporated by reference in the Fermi 3 FSAR adequately describe the snubber inspection and test program as consistent with the ASME OM Code provisions in accordance with Commission policy to review a description of the operational programs (including the snubber IST program) in support of the COL application review. As indicated in License Condition 03.09-01 specified later in this SER section, the licensee will submit a schedule that supports planning and conducting NRC inspections of operational programs. During inspections of the Fermi 3 operational programs, the staff will confirm that the PST and IST Operational Programs (including the snubber program) have been established consistent with the Fermi 3 FSAR and this SER section, including completion of the applicable commitments specified in the Fermi 3 FSAR. Therefore, COL Item 3.9.9-4-A is satisfied.

Supplemental Information

The Fermi 3 COL application also provides three instances of standard supplemental information in Section 3.9. In Section 3.9.6.6, STD SUP 3.9-1 states that no relief from or alternative to the ASME OM Code is being requested. In Section 3.9.7, STD SUP 3.9-2 states that risk-informed IST is not being utilized, replacing a statement in the ESBWR DCD that risk-informed IST initiatives, if any, are included in IST Program implementation plans. Similarly, in Section 3.9.8, STD SUP 3.9-3 states that risk-informed inservice inspection is not being utilized, replacing a statement in the ESBWR DCD that initiatives for risk-informed inservice inspection of piping, if any, are included in inservice inspection implementation plans. All three of these supplemental statements confirm that the Fermi 3 applicant intends to follow the processes for ASME OM Code implementation, IST Program implementation, and inservice inspection implementation described in the ESBWR DCD, as supplemented in the Fermi 3 COL application and evaluated as described in this SER section. Therefore, the staff finds this supplemental information acceptable.

Interfaces for Standard Design

ESBWR DCD Tier 2, Section 1.8, “Interfaces with Standard Design,” identifies site-specific interfaces with the standard ESBWR design. DCD Table 1.8-1, “Matrix of NSSS Interfaces,” references Section 3.9 for the supporting interface areas of mechanical SSCs. The staff reviewed the Fermi 3 COL application for interface requirements with the ESBWR standard design regarding the functional design, qualification, and IST Programs for safety-related valves and dynamic restraints using the review procedures described in SRP Section 3.9.6. The staff finds that the applicant’s consideration of design interface items is acceptable based on compliance with NRC regulations discussed in this SER section.

License Conditions

The staff's review of the Fermi 3 COL application determined the need for three license conditions related to mechanical systems and components described in Fermi 3 FSAR Section 3.9. These conditions are listed in Section 3.9.5, "Post Combined License Activities," of this SER.

3.9.5 Post Combined License Activities

License Conditions

The staff's review of the Fermi 3 COL application determined the need for the following three license conditions related to mechanical systems and components described in Fermi 3 FSAR Section 3.9:

License Condition 03.09-01: FSAR Section 13.4 indicates that FSAR Table 13.4-201 lists each operational program, the regulatory source for the program, the associated implementation milestones, and the FSAR section where the operational program is fully described, as discussed in RG 1.206. RG 1.206, Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule that supports planning and conducting NRC inspections of operational programs. The schedule must be submitted 12 months after the NRC issues the COL. The schedule will be updated every 6 months, until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first.

License Condition 03.09-02: Consistent with the licensing of other passive design new reactors, the NRC staff has prepared a license condition directing the implementation of a surveillance program for squib valves in the Gravity Driven Cooling System and the Automatic Depressurization System at Fermi 3 prior to fuel load to supplement the IST requirements in the ASME OM Code. The license condition is as follows:

Before initial fuel load, the licensee shall implement a surveillance program for explosively actuated valves (squib valves) in the Gravity Driven Cooling System and the Automatic Depressurization System at Fermi 3 that includes the following provisions in addition to the requirements specified in the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) as incorporated by reference in 10 CFR 50.55a.

a. Preservice Testing

All explosively actuated valves shall be preservice tested by verifying the operational readiness of the actuation logic and associated electrical circuits for each explosively actuated valve with its pyrotechnic charge removed from the valve. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available at the explosively actuated valve from each circuit that is relied upon to actuate the valve. In addition, a sample of at least 20 percent of the pyrotechnic charges in all explosively actuated valves shall be tested in the valve or a qualified test fixture to confirm the capability of each sampled pyrotechnic charge to provide the necessary motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. The sampling must select at

least one explosively actuated valve from each redundant safety train. Corrective action shall be taken to resolve any deficiencies identified in the operational readiness of the actuation logic or associated electrical circuits, or the capability of a pyrotechnic charge. If a charge fails to fire or its capability is not confirmed, all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch number that has demonstrated successful 20 percent sampling of the charges.

b. Operational Surveillance

Explosively actuated valves shall be subject to the following surveillance activities after commencing plant operation:

(1) At least once every 2 years, each explosively actuated valve shall undergo visual external examination and remote internal examination (including evaluation and removal of fluids or contaminants that may interfere with operation of the valve) to verify the operational readiness of the valve and its actuator. This examination shall also verify the appropriate position of the internal actuating mechanism and proper operation of remote position indicators. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the PST requirements.

(2) At least once every 10 years, each explosively actuated valve shall be disassembled for internal examination of the valve and actuator to verify the operational readiness of the valve assembly and the integrity of individual components and to remove any foreign material, fluid, or corrosion. The examination schedule shall provide for each valve design used for explosively actuated valves at the facility to be included among the explosively actuated valves to be disassembled and examined every 2 years. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the PST requirements.

(3) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the operational readiness of the actuation logic and associated electrical circuits shall be verified for each sampled explosively actuated valve following removal of its charge. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available for each valve actuation circuit. Corrective action shall be taken to resolve any deficiencies identified in the actuation logic or associated electrical circuits.

(4) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the sampling must select at least one explosively actuated valve from each redundant safety train. Each sampled pyrotechnic charge shall be tested in the valve or a qualified test fixture to confirm the capability of the charge to provide the necessary motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. Corrective action shall be taken to resolve any deficiencies identified in the capability of a pyrotechnic charge in accordance with the PST requirements.

This license condition shall expire upon (1) incorporation of the above surveillance provisions for explosively actuated valves into the facility's inservice testing program, or (2) incorporation of inservice testing requirements for explosively actuated valves in new reactors (i.e., plants receiving a construction permit, or combined license for construction and operation, after January 1, 2000) to be specified in a future edition of the ASME OM Code as incorporated by reference in 10 CFR 50.55a, including any conditions imposed by the NRC, into the facility's inservice testing program.

This license condition supplements the current requirements in the ASME OM Code for explosively actuated valves, and sets forth requirements for both pre-service testing and operational surveillance, as well as any necessary corrective action. The license condition will expire when either (1) the license condition is incorporated into the Fermi 3 IST program; or (2) the updated ASME OM Code requirements for squib valves in new reactors, as accepted by the NRC in 10 CFR 50.55a, are incorporated into the Fermi 3 IST program. For the purpose of satisfying the license condition, the licensee retains the option of including in its IST program either the requirements stated in this condition, or including updated ASME Code requirements.

License Condition 03.09-03: The licensee shall use supporting information in Reports NEDE-33312P (Revision 5, December 2013) and NEDE-33313P (Revision 5, December 2013) for implementing the actions associated with the following license conditions:

1.a A Steam Dryer Monitoring Plan (SDMP) for the steam dryer shall be prepared and provided to the NRC no later than 90 days before startup.

1.b Power Ascension Test (PAT) procedures for the steam dryer testing shall be provided to NRC inspectors no later than 10 days before startup. The PAT procedures shall include the following:

- Level 1 and Level 2 acceptance limits for on-dryer strain gages, and on-dryer accelerometers to be used up to 100% power.
- Specific hold points and their duration during 100% power ascension.
- Activities to be accomplished during hold points.
- Plant parameters to be monitored.
- Actions to be taken if acceptance criteria are not satisfied.
- Verification of the completion of commitments and planned actions.

2. An initial hold point during the first power ascension shall be at no more than 75 percent of full power. At this hold point, the licensee shall complete the actions specified in Item 2 of the model license condition specified in paragraph (c) of Section 10.2, "Comprehensive Vibration Program Elements for a COL Applicant," in NEDE-33313P (Revision 5).

3. Continue power ascension with subsequent hold points at approximately 5 percent power level increments where pressures, strains, and accelerations will be recorded and evaluated. Data trending and a projection of strain levels will be generated for the next hold point and full power. Data trending analysis during power ascension must assess whether the limits would be violated at higher power levels. Data

trending results and revised limit curves will be made available to the NRC at each hold point.

4. Power ascension monitoring shall address expected increases in loading and fatigue damage due to variable plant conditions throughout the life of the dryer.

5. Flow-induced resonances: The licensee shall complete the actions specified in Item 5 of the model license condition specified in paragraph (c) of Section 10.2 in NEDE-33313P (Revision 5).

6. End-to-end bias and uncertainties shall be determined by comparing the predicted and measured strain or acceleration on the steam dryer at each hold point to confirm the conservatism of the predicted dryer stress field. Adjust the predicted strain and acceleration responses using the frequency-dependent end-to-end bias errors and uncertainty values. If any of the measured sensor data exceed the adjusted predictions, then either modify the bias errors and uncertainty values and limit curves and ensure measured sensor responses do not exceed the adjusted predictions, or quantitatively evaluate the impact on fatigue life.

7. At the initial hold point and the hold points at approximately 85 and 95 percent power, power ascension shall not proceed for at least 72 hours after making the steam dryer data analysis and results available to the NRC by facsimile or electronic transmission to the NRC project manager.

8. During the Power Maneuvering in the Feedwater Temperature Operating Domain testing, pressures, strains, and accelerations shall be recorded from the on-dryer mounted instrumentation across the expected range of normal steady state plant operating conditions. An evaluation of the dryer structural response over the range of steady state plant operating conditions shall be included in the stress analysis report described in Item 9 below.

9. After full power has been achieved, data at the full power level will be provided to the NRC within 72 hours, and a full stress analysis report and evaluation will be provided to the NRC within 90 days of reaching the full power level. The report will include the minimum stress ratio and the final dryer load definition using steam dryer instrumentation, and associated bias errors and uncertainties, to demonstrate that the steam dryer will maintain its structural integrity over its design life considering variations in plant parameters (such as reactor pressure and core flow rate).

10. A periodic steam dryer inspection program shall be implemented as follows:

    a. During the first two scheduled refueling outages after reaching full power conditions, a visual inspection shall be conducted of all accessible areas and susceptible locations of the steam dryer in accordance with accepted industry guidance on steam dryer inspections. The results of these baseline inspections shall be provided to the NRC within 60 days following startup after each outage.

    b. At the end of the second refueling outage following full power operation, an updated SDMP reflecting a long-term inspection plan based on plant-specific and

industry operating experience shall be provided to the NRC within 180 days following startup from the second refueling outage.

In addition to the above three license conditions, the NRC staff notes that, as discussed earlier in this SER section, Part 10 of the Fermi 3 COL application lists a detailed license condition for the Initial Test Program that includes activities to address COL Item STD COL 14.2.3-A, "Preoperational and Startup Test Procedures." This license condition will ensure that the COL licensee implements the initial test program (ITP), which includes the reactor internals initial start-up flow-induced vibration testing.

Commitments

In Section 3.9 of the Fermi 3 FSAR, the applicant specifies the following commitments:

Commitment (COM 3.9-001) – For reactor internals other than the steam dryer, the comprehensive vibration assessment program will be developed and implemented as described in DCD Appendix 3L with no departures. The vibration measurement and inspection programs will comply with the guidance specified in RG 1.20, Revision 3, consistent with the Fermi 3 reactor internals classification. A summary of the vibration analysis program and description of the vibration measurement (including measurement locations and analysis predictions) and inspection phases of the comprehensive vibration inspection program will be submitted to the NRC six months prior to implementation.

Commitment (COM 3.9-002) – The equipment stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1.

Commitment (COM 3.9-003) – For the ASME Class 1, 2, and 3 systems listed in DCD Tier 1, Section 3.1, that contain snubbers, a plant-specific table will be prepared in conjunction with the closure of the system-specific ITAAC for piping and component design and will include the following specific snubber information.

Commitment (COM 3.9-004) – The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.

Commitment (COM 3.9-005) – This information will be included in the FSAR as part of a subsequent FSAR update.

Commitment (COM 3.9-006) – For reactor internals other than the steam dryer, the preliminary and final reports (as necessary), which together summarize the results of the vibration analysis, measurement and inspection programs will be submitted to the NRC within 60 and 180 days, respectively, following the completion of the programs.

ITAAC

ESBWR DCD Tier 1 includes numerous ITAAC to verify the acceptability of the as-built mechanical systems and components at Fermi 3. A sample of the ITAAC related to the Fermi 3 steam dryer includes the following:

ESBWR DCD Tier 1, Table 2.1.1-3, "ITAAC for the Reactor Pressure Vessel and Internals"

ITAAC Item 8b. The RPV internal structures listed in Table 2.1.1-1 (chimney and partitions, chimney head and steam separators assembly, and steam dryer assembly) meet the requirements of ASME BPV Code, Subsection NG-3000, except for the weld quality and fatigue factors for secondary structural non-load bearing welds.

ITAAC Item 12. The number and locations of pressure sensors installed on the steam dryer for startup testing ensure accurate pressure predictions at critical locations.

ITAAC Item 13. The number and locations of strain gages and accelerometers installed on the steam dryer for startup testing are capable of monitoring the most highly stressed components, considering accessibility and avoiding discontinuities in the components.

ITAAC Item 14. The number and locations of accelerometers installed on the steam dryer for startup testing are capable of identifying potential rocking and of measuring the accelerations resulting from support and vessel movements.

ITAAC Item 16. The as-built steam dryer predicted peak stress is below the fatigue limitation. ESBWR DCD Tier 1, Table 2.1.2-3, "ITAAC for the Nuclear Boiler System"

ITAAC Item 36. The main steam line and SRV/SV [safety-related valve/safety valve] branch piping geometry precludes first and second shear layer wave acoustic resonance conditions from occurring and avoids pressure loads on the steam dryer at plant normal operating conditions. With respect to the ESBWR steam dryer, NEDE-33313P specifies Tier 2* provisions for the COL licensee to complete the design and construction of the steam dryer for an ESBWR nuclear power plant. For example, Section 9.1, "Instrumentation for Monitoring Steam Dryer Response," in NEDE-33313P describes the process to meet ITAAC Items 12, 13, and 14 in DCD Tier 1, Table 2.1.1-3, for the installation of pressure sensors; strain gages; and accelerometers on the as-built steam dryer to monitor its performance during power ascension. Section 10.1.1, "Steam Dryer Design Analysis Report," in NEDE-33313P specifies the elements for the as-designed ESBWR steam dryer analysis report. Section 10.1.2, "Steam Dryer As-Built Analysis Report," in NEDE-33313P specifies the process to satisfy ITAAC Item 16 in DCD Tier 1, Table 2.1.1-3, for verifying that the as-built steam dryer fatigue analysis provides at least a minimum alternating stress ratio (MASR) of 2.0 to the allowable alternating stress intensity of 93.7 MPa (13,600 psi). Appendix A, "ITAAC for Reactor Pressure Vessel Internals," to NEDE-33313P describes the process to meet ITAAC Item 8.b in DCD Tier 1, Table 2.1.1-3, so as to provide assurance that the reactor internal structures will meet the provisions of ASME BPV Code, Subsection NG-3000, except for the weld quality and fatigue factors for secondary structural non-load bearing welds. Appendix B, "ITAAC for Main Steam Line and SRV/Safety Valve Branch Piping Acoustic Resonance," to NEDE-33313P describes the process to meet ITAAC 36 in DCD Tier 1, Table 2.1.2-3, to provide assurance that the main steam line and SRV/SV branch piping geometry will preclude first and second shear layer wave acoustic resonance conditions from occurring and avoids excessive pressure loads on the steam dryer at plant normal operating conditions. These post combined license activities for the ESBWR steam dryer will be performed by the COL licensee for Fermi 3, as described by the Tier 2* provisions in the ESBWR DCD and its referenced engineering reports, unless the COL licensee obtains regulatory approval for an alternative process.

3.9.6 Conclusion

The NRC staff reviewed Fermi 3 FSAR Section 3.9 and the provisions specified in ESBWR DCD Tier 2, Section 3.9 that are incorporated by reference in the Fermi 3 FSAR for structural

integrity and functional capability of mechanical systems and components for the Fermi 3 nuclear power plant. The staff review of the information provided in Section 3.9 of the ESBWR DCD Tier 2 is provided in the FSER on the ESBWR design certification applicant as modified by the Advanced Supplemental FSER (ADAMS Accession Number ML14043A134) on Section 3.9.5 of the ESBWR DCD Tier 2. Based on its review, the staff concludes that the Fermi 3 COL applicant has provided reasonable assurance that mechanical systems and components to be installed in Fermi 3 will have the structural integrity and functional capability to perform their design functions for the safe operation of the Fermi 3 nuclear power plant.